



# Stormwater Impact Analysis

The Point / AWH-20000 / June 2020



# THE POINT

*ROLESVILLE, NORTH CAROLINA*

## STORMWATER IMPACT ANALYSIS

### SITE PLAN

*PLANNING #: SUP 18-09*

PROJECT NUMBER:

AWH-20000

DESIGNED BY:

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DATE:

JUNE 2020



McADAMS

2905 MERIDIAN PARKWAY

DURHAM, NORTH CAROLINA 27713

NC LIC. # C-0293

## THE POINT

### *Stormwater Impact Analysis*

#### GENERAL DESCRIPTION

The Point is a proposed residential development in Rolesville, North Carolina, located between Highway 401 and East Young Street/Rolesville Road. The development is approximately 300 acres, divided into a northern parcel (to be developed at a later date) and a southern parcel. This Stormwater Impact Analysis covers the development of the southern parcel only. The development will consist of approximately 804 lots, a mixture of townhomes and various types of single-family housing, thirteen stormwater control measures, sidewalks, roadways, greenway trail, and associated infrastructure.

The project site is located in the Neuse River Basin, and drains to Harris Creek (Peeples Creek / Wake Crossroads Lake) (BIMS # 27-26) and is classified as C;NSW. Per Town of Rolesville regulations, stormwater management on this site shall meet the stormwater management performance standards for development set forth in the Rolesville Unified Development Ordinance Article 7, Section 7.5.4 – Standards.

The regulations are as follows:

#### (B) Standards Based on Project Density

(4) **Development Standards for High-Density Projects** High-Density Projects shall implement stormwater control measures that comply with each of the following standards, in addition to the General Standards found in subsection B of this Section:

- (a) The measures shall control and treat runoff from the first inch of rain. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours.
- (b) All structural stormwater treatment systems used to meet these requirements shall be designed to have a minimum of 85 percent average annual removal for Total Suspended Solids (TSS).
- (c) All Development and Redevelopment projects required to manage storm water shall provide permanent on-site BMPs to lower the nitrogen export amounts as part of the storm water management plan. BMPs are to be in accordance with and as specified in the Design Manual.
- (d) Structural and Non-structural BMPs shall be used to ensure there is no net increase in peak flow leaving the site from the pre-Development conditions for the one-year, 24-hour storm. Runoff volume drawdown time shall be a minimum of 48 hours, but not more than 120 hours.
- (e) General engineering design criteria for all projects shall be in accordance with 15A NCAC 2H .1008(c), as explained in the Design Manual;
- (f) All Development and Redevelopment shall be located outside the Riparian Buffer Zone and the Flood Protection Zone. These Zones shall be in accordance with the following provisions:
  - i. Except where other applicable buffer standards are more restrictive, the Riparian Buffer Zone shall extend a minimum of 50 feet landward of all Perennial and Intermittent Surface Waters. The most restrictive standards shall apply.
  - ii. The Riparian Buffer Zone shall remain undisturbed unless otherwise permitted by this section.
  - iii. The Flood Protection Zone shall extend throughout the FEMA 100-year floodplain as identified on the current Flood Insurance Rate Map (FIRM) published by FEMA. The Flood Protection Zone shall remain undisturbed unless otherwise permitted by this section.
  - iv. No Development or Redevelopment is permitted within the Riparian Buffer Zone or the Flood Protection Zone except for stream bank or shoreline restoration or stabilization, water dependent structures, and public or private projects such as road crossings and installations, utility crossings and installations, and greenways, where no practical alternatives exist.

- v. Permitted activities within the Riparian Buffer Zone and the Flood Protection Zone shall minimize impervious coverage, direct runoff away from surface waters to achieve diffuse flow, and maximize the utilization of Non-structural BMPs.
  - vi. Where the Riparian Buffer Zone and the Flood Protection Zone both are present adjacent to surface waters, the more restrictive shall apply.
- (g) The approval of the stormwater permit shall require an enforceable restriction on property usage that runs with the land, such as recorded deed restrictions or protective covenants, to ensure that future Development and Redevelopment maintains the site consistent with the approved project plans. Buffer widths and locations shall be clearly delineated on all plans, final plat, and as-builts.

#### (B) General Standards

**(1) Downstream Impact Analysis** The downstream impact analysis must be performed in accordance with the "ten percent rule," and a copy of the analysis must be provided with the permit application. The purpose of the downstream impact analysis is to determine if the project will cause any impacts on flooding or channel degradation downstream of the project site. The analysis must include the assumptions, results and supporting calculations to show safe passage of post-Development design flows downstream. This analysis shall be performed at the outlet(s) of the site, and downstream at each tributary junction to the point(s) in the conveyance system where the area of the portion of the site draining into the system is less than or equal to ten percent of the total drainage area above that point.

**(2) Standards for Stormwater Control Measures**

**(a) Evaluation According to Contents of Design Manual** All stormwater control measures and stormwater treatment practices (or BMPs) required under this ordinance shall be evaluated by the Stormwater Administrator according to the policies, criteria, and information, including technical specifications and standards and the specific design criteria for each stormwater practice, in the Design Manual. The Stormwater Administrator shall determine whether proposed BMPs will be adequate to meet the requirements of this ordinance.

**(b) Determination of Adequacy; Presumptions and Alternatives** Stormwater treatment practices that are designed, constructed, and maintained in accordance with the criteria and specifications in the Design Manual will be presumed to meet the minimum water quality and quantity performance standards of this ordinance. Whenever an applicant proposes to utilize a practice or practices not designed and constructed in accordance with the criteria and specifications in the Design Manual, the applicant shall have the burden of demonstrating that the practice(s) will satisfy the minimum water quality and quantity performance standards of this ordinance. The Stormwater Administrator may require the applicant to provide the documentation, calculations, and examples necessary for the Stormwater Administrator to determine whether such an affirmative showing is made.

**(c) Separation from Seasonal High Water Table** For BMPs that require a separation from the seasonal high-water table, the separation shall be provided by at least 12 inches of naturally occurring soil above the seasonal high-water table.

### CALCULATION METHODOLOGY

- Rainfall data for this area in the Rolesville, NC region is from NOAA Atlas 14. This data contains a depth-duration-frequency (DDF) table describing rainfall depth versus time for varying return periods in the area. These rainfall depths are input into the meteorological model within PondPack for peak flow rate calculations. Please reference the precipitation information within the Miscellaneous Site Information section of this report for additional information.
- On-site and off-site soils were determined using best available GIS data sources.

- Soil Conservation Service Curve Numbers (SCS CN) were selected from Table 2 of the USDA TR-55 for the land use that is most similar to the zoning type or cover condition.
- Land cover conditions for the pre-development condition were taken from survey provided by WithersRavenel and aerial imagery for the site. Land cover conditions for the post-development condition were taken from the proposed layout. Offsite cover conditions were based on GIS-based zoning mapping, provided by the Town of Rolesville.
- The time of concentration was calculated using SCS TR-55 (Segmental Approach, 1986). The Tc flow path can be divided into three segments: overland flow, concentrated flow, and channel flow. The travel time was then computed for each segment, from which the overall time of concentration was determined by taking the sum of each segmental time.
- Existing topographic information used in this analysis is from survey provided by WithersRavenel and QL2 LiDAR from North Carolina's Spatial Data Download.
- PondPack Version V8i was used in determining the pre- & post-development peak flow rates for the 1- and 10-year storm events, as well as routing calculations for the proposed stormwater control measures.
- For 100-year storm routing calculations, a “worst-case” condition was modeled in order to ensure the proposed facility would safely pass the 100-year storm event. The assumptions used in this scenario are as follows:
  - The starting water surface elevation in the facility, just prior to the 100-year storm event, is at the invert of the secondary orifice. This scenario could occur as a result of a clogged primary orifice or a rainfall event that lingers for several days. This could also occur as a result of several rainfall events in a series, before the low-flow orifice has an opportunity to draw down the storage pool.
  - Approximately 1-foot of freeboard is provided between the peak elevation during the “worst-case” scenario and the top of the dam for the proposed facility.

To meet the above Town of Rolesville standards, thirteen stormwater control measures (SCMs) have been proposed.

## DISCUSSION OF RESULTS

### PEAK RUNOFF CONTROL REQUIREMENTS

As shown in the Summary of Results section of this SIA, the proposed stormwater control measures provide the necessary peak runoff control for the proposed build-out condition of the development such that there are no calculated increases in the 1- and 10-year storm events at any point of analysis leaving the site.

### POLLUTANT AND NUTRIENT CONTROL REQUIREMENTS

The proposed SCM is designed to the Minimum Design Criteria of the NCDEQ Stormwater Design Manual. Therefore, the proposed development is treated for 85% TSS removal and provides nitrogen and phosphorus treatment.

## CONCLUSION

If the development on this tract is built as proposed within this report, then the requirements set forth in Town of Rolesville regulations will be met without additional stormwater management facilities. However, modifications to the proposed development may require that this analysis be revised. Some modifications that would **require** this analysis to be revised include:

1. The proposed site impervious surface exceeds the amount accounted for in this report.
2. The post-development watershed breaks change significantly from those used to prepare this report.

The above modifications may result in the assumptions within this report becoming invalid. The computations within this report will need to be revisited if any of the above conditions become apparent as development of the proposed site moves forward.

<b>1</b>	SUMMARY OF RESULTS
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## *SUMMARY OF RESULTS*

**RELEASE RATE MANAGEMENT RESULTS**

<b>POINT OF ANALYSIS #1</b>			
<b>Return Period</b>	<b>Pre-Dev</b> [cfs]	<b>Post-Dev</b> [cfs]	<b>% Increase</b> [%]
1-Year	283.5	195.5	-31%
10-Year	545.3	446.9	-18%
<b>POINT OF ANALYSIS #2</b>			
<b>Return Period</b>	<b>Pre-Dev</b> [cfs]	<b>Post-Dev</b> [cfs]	<b>% Increase</b> [%]
1-Year	77.3	75.1	-3%
10-Year	153.0	142.1	-7%
<b>POINT OF ANALYSIS #3</b>			
<b>Return Period</b>	<b>Pre-Dev</b> [cfs]	<b>Post-Dev</b> [cfs]	<b>% Increase</b> [%]
1-Year	8.2	6.0	-26%
10-Year	21.2	15.1	-29%
<b>POINT OF ANALYSIS #4</b>			
<b>Return Period</b>	<b>Pre-Dev</b> [cfs]	<b>Post-Dev</b> [cfs]	<b>% Increase</b> [%]
1-Year	80.9	52.5	-35%
10-Year	204.9	194.5	-5%
<b>POINT OF ANALYSIS #5</b>			
<b>Return Period</b>	<b>Pre-Dev</b> [cfs]	<b>Post-Dev</b> [cfs]	<b>% Increase</b> [%]
1-Year	359.7	353.5	-2%
10-Year	787.2	787.1	0%
<b>POINT OF ANALYSIS #6</b>			
<b>Return Period</b>	<b>Pre-Dev</b> [cfs]	<b>Post-Dev</b> [cfs]	<b>% Increase</b> [%]
1-Year	8.3	1.1	-87%
10-Year	22.0	19.1	-13%
<b>POINT OF ANALYSIS #7</b>			
<b>Return Period</b>	<b>Pre-Dev</b> [cfs]	<b>Post-Dev</b> [cfs]	<b>% Increase</b> [%]
1-Year	2.4	1.9	-24%
10-Year	17.2	4.8	-72%
<b>POINT OF ANALYSIS #8</b>			
<b>Return Period</b>	<b>Pre-Dev</b> [cfs]	<b>Post-Dev</b> [cfs]	<b>% Increase</b> [%]
1-Year	0.3	0.3	0%
10-Year	4.3	2.9	-34%

**STORMWATER CONTROL MEASURE 'A' SUMMARY**

Design Drainage Area =	12.71	ac
Design Impervious Area =	6.33	ac
% Impervious =	49.8%	
Top of Dam =	386.00	ft
NWSE =	380.00	ft
WQv Ponding Elevation =	381.64	ft
Required Main Pool Surface Area at NWSE =	9,867	sf
Total Surface Area Provided at NWSE =	12,708	sf
Estimate of Provided Main Pool Surface Area at NWSE =	10,166	sf
<b>*Assume main pool 80% of total normal pool area</b>		
WQv Orifice Diameter =	2.00	in
WQv Orifice Invert Elevation =	380.00	ft
Riser Size =	4' x 4'	
Riser Crest =	383.50	ft
Barrel Diameter =	24	in
# of Barrels =	1	
Upstream Invert =	379.00	ft
Downstream Invert =	378.00	ft
Length =	50	ft
Slope =	0.0200	ft/ft

**STORMWATER CONTROL MEASURE 'A' ROUTING RESULTS**

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	22.5	0.2	382.76	3.24
10-Year	53.2	13.2	383.92	2.08
25-Year	64.9	25.1	384.15	1.85
100-Year	82.1	37.6	384.90	1.10

**STORMWATER CONTROL MEASURE 'B' SUMMARY**

Design Drainage Area =	10.54	ac
Design Impervious Area =	7.21	ac
% Impervious =	68.4%	
Top of Dam =	382.00	ft
NWSE =	376.00	ft
WQv Ponding Elevation =	378.18	ft
Required Main Pool Surface Area at NWSE =	9,345	sf
Total Surface Area Provided at NWSE =	9,911	sf
Estimate of Provided Main Pool Surface Area at NWSE =	7,929	sf
<b>*Assume main pool 80% of total normal pool area</b>		
WQv Orifice Diameter =	2.00	in
WQv Orifice Invert Elevation =	376.00	ft
Riser Size =	4' x 4'	
Riser Crest =	379.00	ft
Barrel Diameter =	24	in
# of Barrels =	1	
Upstream Invert =	375.00	ft
Downstream Invert =	374.00	ft
Length =	50	ft
Slope =	0.0200	ft/ft

**STORMWATER CONTROL MEASURE 'B' ROUTING RESULTS**

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	33.6	5.4	379.23	2.77
10-Year	60.0	34.1	380.10	1.90
25-Year	68.9	35.9	380.51	1.49
100-Year	81.7	37.9	380.96	1.04

**STORMWATER CONTROL MEASURE 'C' SUMMARY**

Design Drainage Area =	17.45	ac
Design Impervious Area =	10.07	ac
% Impervious =	57.7%	
Top of Dam =	382.00	ft
NWSE =	376.00	ft
WQv Ponding Elevation =	377.97	ft
Required Main Pool Surface Area at NWSE =	12,981	sf
Total Surface Area Provided at NWSE =	16,533	sf
Estimate of Provided Main Pool Surface Area at NWSE =	13,226	sf
<b>*Assume main pool 80% of total normal pool area</b>		
WQv Orifice Diameter =	2.75	in
WQv Orifice Invert Elevation =	376.00	ft
Riser Size =	5' x 5'	
Riser Crest =	379.00	ft
Barrel Diameter =	36	in
# of Barrels =	1	
Upstream Invert =	374.50	ft
Downstream Invert =	374.00	ft
Length =	50	ft
Slope =	0.0100	ft/ft

**STORMWATER CONTROL MEASURE 'C' ROUTING RESULTS**

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	46.0	2.2	379.10	2.90
10-Year	90.2	55.7	379.95	2.05
25-Year	105.7	76.2	380.24	1.76
100-Year	128.0	80.5	380.66	1.34

**STORMWATER CONTROL MEASURE 'D' SUMMARY**

Design Drainage Area =	13.40	ac
Design Impervious Area =	6.79	ac
% Impervious =	50.7%	
Top of Dam =	360.00	ft
NWSE =	354.00	ft
WQv Ponding Elevation =	355.10	ft
Required Main Pool Surface Area at NWSE =	10,551	sf
Total Surface Area Provided at NWSE =	21,630	sf
Estimate of Provided Main Pool Surface Area at NWSE =	17,304	sf
<b>*Assume main pool 80% of total normal pool area</b>		
WQv Orifice Diameter =	2.50	in
WQv Orifice Invert Elevation =	354.00	ft
Riser Size =	4' x 4'	
Riser Crest =	358.00	ft
Barrel Diameter =	24	in
# of Barrels =	1	
Upstream Invert =	353.00	ft
Downstream Invert =	352.00	ft
Length =	50	ft
Slope =	0.0200	ft/ft

**STORMWATER CONTROL MEASURE 'D' ROUTING RESULTS**

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	26.8	0.2	355.96	4.04
10-Year	59.9	1.5	358.08	1.92
25-Year	72.2	6.5	358.25	1.75
100-Year	90.1	25.3	358.65	1.35

**STORMWATER CONTROL MEASURE 'E' SUMMARY**

Design Drainage Area =	12.25	ac
Design Impervious Area =	6.96	ac
% Impervious =	56.8%	
Top of Dam =	364.00	ft
NWSE =	358.00	ft
WQv Ponding Elevation =	358.98	ft
Required Main Pool Surface Area at NWSE =	10,631	sf
Total Surface Area Provided at NWSE =	24,701	sf
Estimate of Provided Main Pool Surface Area at NWSE =	19,761	sf
<b>*Assume main pool 80% of total normal pool area</b>		
WQv Orifice Diameter =	2.00	in
WQv Orifice Invert Elevation =	358.00	ft
Riser Size =	4' x 4'	
Riser Crest =	362.00	ft
Barrel Diameter =	24	in
# of Barrels =	1	
Upstream Invert =	357.00	ft
Downstream Invert =	356.00	ft
Length =	50	ft
Slope =	0.0200	ft/ft

**STORMWATER CONTROL MEASURE 'E' ROUTING RESULTS**

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	35.6	0.2	360.35	3.65
10-Year	66.6	1.8	362.10	1.90
25-Year	77.2	6.5	362.26	1.74
100-Year	92.6	24.4	362.63	1.37

**STORMWATER CONTROL MEASURE 'F' SUMMARY**

Design Drainage Area =	23.05	ac
Design Impervious Area =	14.96	ac
% Impervious =	64.9%	
Top of Dam =	350.00	ft
NWSE =	344.00	ft
WQv Ponding Elevation =	346.66	ft
Required Main Pool Surface Area at NWSE =	19,322	sf
Total Surface Area Provided at NWSE =	17,546	sf
Estimate of Provided Main Pool Surface Area at NWSE =	14,037	sf
<b>*Assume main pool 80% of total normal pool area</b>		
WQv Orifice Diameter =	3.00	in
WQv Orifice Invert Elevation =	344.00	ft
Riser Size =	6' x 6'	
Riser Crest =	347.00	ft
Number of Weirs =	3	
Weir Length =	4.00	ft
Weir Inver El. =	346.80	ft
Barrel Diameter =	42	in
# of Barrels =	1	
Upstream Invert =	342.50	ft
Downstream Invert =	342.00	ft
Length =	50	ft
Slope =	0.0100	ft/ft

**STORMWATER CONTROL MEASURE 'F' ROUTING RESULTS**

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	73.6	23.7	347.29	2.71
10-Year	131.2	96.6	348.12	1.88
25-Year	150.7	101.2	348.41	1.59
100-Year	178.7	107.7	348.87	1.13

**STORMWATER CONTROL MEASURE 'G' SUMMARY**

Design Drainage Area =	13.48	ac
Design Impervious Area =	9.11	ac
% Impervious =	67.6%	
Top of Dam =	348.00	ft
NWSE =	342.00	ft
WQv Ponding Elevation =	343.66	ft
Required Main Pool Surface Area at NWSE =	14,125	sf
Total Surface Area Provided at NWSE =	17,615	sf
Estimate of Provided Main Pool Surface Area at NWSE =	14,092	sf
<b>*Assume main pool 80% of total normal pool area</b>		
WQv Orifice Diameter =	2.75	in
WQv Orifice Invert Elevation =	342.00	ft
Riser Size =	5' x 5'	
Riser Crest =	346.00	ft
Number of Orifices =	2	
Orifice Size =	6.00	in
Orifice Invert El. =	343.80	ft
Barrel Diameter =	36	in
# of Barrels =	1	
Upstream Invert =	340.50	ft
Downstream Invert =	340.00	ft
Length =	50	ft
Slope =	0.0100	ft/ft

**STORMWATER CONTROL MEASURE 'G' ROUTING RESULTS**

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	46.8	2.1	344.92	3.08
10-Year	79.9	20.0	346.43	1.57
25-Year	91.0	43.8	346.77	1.23
100-Year	106.9	74.3	347.13	0.87

**STORMWATER CONTROL MEASURE 'H' SUMMARY**

Design Drainage Area =	16.12	ac
Design Impervious Area =	9.16	ac
% Impervious =	56.8%	
Top of Dam =	340.00	ft
NWSE =	334.00	ft
WQv Ponding Elevation =	335.55	ft
Required Main Pool Surface Area at NWSE =	13,984	sf
Total Surface Area Provided at NWSE =	19,424	sf
Estimate of Provided Main Pool Surface Area at NWSE =	15,539	sf
<b>*Assume main pool 80% of total normal pool area</b>		
WQv Orifice Diameter =	2.75	in
WQv Orifice Invert Elevation =	334.00	ft
Riser Size =	5' x 5'	
Riser Crest =	338.00	ft
Number of Orifices =	3	
Orifice Size =	8.00	in
Orifice Invert El. =	335.70	ft
Barrel Diameter =	36	in
# of Barrels =	1	
Upstream Invert =	332.50	ft
Downstream Invert =	332.00	ft
Length =	50	ft
Slope =	0.0100	ft/ft

**STORMWATER CONTROL MEASURE 'H' ROUTING RESULTS**

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	49.2	4.0	336.56	3.44
10-Year	89.7	20.9	338.36	1.64
25-Year	103.6	42.9	338.69	1.31
100-Year	123.4	76.7	339.13	0.87

**STORMWATER CONTROL MEASURE 'I' SUMMARY**

Design Drainage Area =	9.24	ac
Design Impervious Area =	5.03	ac
% Impervious =	54.4%	
Top of Dam =	324.00	ft
NWSE =	318.00	ft
WQv Ponding Elevation =	319.62	ft
Required Main Pool Surface Area at NWSE =	7,726	sf
Total Surface Area Provided at NWSE =	10,342	sf
Estimate of Provided Main Pool Surface Area at NWSE =	8,274	sf
<b>*Assume main pool 80% of total normal pool area</b>		
WQv Orifice Diameter =	2.00	in
WQv Orifice Invert Elevation =	318.00	ft
Riser Size =	4' x 4'	
Riser Crest =	321.50	ft
Number of Orifices =	3	
Orifice Size =	6.00	in
Orifice Invert El. =	319.80	ft
Barrel Diameter =	24	in
# of Barrels =	1	
Upstream Invert =	316.50	ft
Downstream Invert =	316.00	ft
Length =	50	ft
Slope =	0.0100	ft/ft

**STORMWATER CONTROL MEASURE 'I' ROUTING RESULTS**

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	25.6	2.1	320.52	3.48
10-Year	49.0	21.1	322.00	2.00
25-Year	57.1	35.8	322.30	1.70
100-Year	68.8	39.4	322.85	1.15

**STORMWATER CONTROL MEASURE 'J' SUMMARY**

Design Drainage Area =	11.68	ac
Design Impervious Area =	6.72	ac
% Impervious =	57.5%	
Top of Dam =	316.00	ft
NWSE =	310.00	ft
WQv Ponding Elevation =	311.42	ft
Required Main Pool Surface Area at NWSE =	10,239	sf
Total Surface Area Provided at NWSE =	15,533	sf
Estimate of Provided Main Pool Surface Area at NWSE =	12,426	sf
<b>*Assume main pool 80% of total normal pool area</b>		
WQv Orifice Diameter =	2.25	in
WQv Orifice Invert Elevation =	310.00	ft
Riser Size =	5' x 5'	
Riser Crest =	313.70	ft
Number of Orifices =	1	
Orifice Size =	6.00	in
Orifice Invert El. =	311.60	ft
Barrel Diameter =	24	in
# of Barrels =	1	
Upstream Invert =	308.50	ft
Downstream Invert =	308.00	ft
Length =	50	ft
Slope =	0.0100	ft/ft

**STORMWATER CONTROL MEASURE 'J' ROUTING RESULTS**

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	34.0	0.9	312.51	3.49
10-Year	63.5	9.4	314.55	1.45
25-Year	73.6	18.5	314.72	1.28
100-Year	88.2	47.4	315.13	0.87

**STORMWATER CONTROL MEASURE 'K' SUMMARY**

Design Drainage Area =	5.25	ac
Design Impervious Area =	2.26	ac
% Impervious =	43.0%	
Top of Dam =	316.00	ft
NWSE =	310.00	ft
WQv Ponding Elevation =	311.37	ft
Required Main Pool Surface Area at NWSE =	3,640	sf
Total Surface Area Provided at NWSE =	5,679	sf
Estimate of Provided Main Pool Surface Area at NWSE =	4,543	sf
<b>*Assume main pool 80% of total normal pool area</b>		
WQv Orifice Diameter =	1.25	in
WQv Orifice Invert Elevation =	310.00	ft
Riser Size =	4' x 4'	
Riser Crest =	314.00	ft
Barrel Diameter =	24	in
# of Barrels =	1	
Upstream Invert =	308.50	ft
Downstream Invert =	308.00	ft
Length =	67	ft
Slope =	0.0075	ft/ft

**STORMWATER CONTROL MEASURE 'K' ROUTING RESULTS**

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	15.3	0.1	314.00	2.00
10-Year	28.5	12.3	314.40	1.60
25-Year	33.1	23.9	314.63	1.37
100-Year	39.7	35.2	314.82	1.18

**STORMWATER CONTROL MEASURE 'L' SUMMARY**

Design Drainage Area =	15.25	ac
Design Impervious Area =	8.63	ac
% Impervious =	56.6%	
Top of Dam =	306.00	ft
NWSE =	300.00	ft
WQv Ponding Elevation =	301.29	ft
Required Main Pool Surface Area at NWSE =	13,189	sf
Total Surface Area Provided at NWSE =	23,079	sf
Estimate of Provided Main Pool Surface Area at NWSE =	18,463	sf
<b>*Assume main pool 80% of total normal pool area</b>		
WQv Orifice Diameter =	3.00	in
WQv Orifice Invert Elevation =	300.00	ft
Riser Size =	5' x 5'	
Riser Crest =	303.50	ft
Number of Orifices =	1	
Orifice Size =	6.00	in
Orifice Invert El. =	301.50	ft
Barrel Diameter =	36	in
# of Barrels =	1	
Upstream Invert =	298.50	ft
Downstream Invert =	298.00	ft
Length =	50	ft
Slope =	0.0100	ft/ft

**STORMWATER CONTROL MEASURE 'L' ROUTING RESULTS**

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	44.4	1.1	302.40	3.60
10-Year	82.9	19.1	303.93	2.07
25-Year	96.2	38.1	304.21	1.79
100-Year	115.2	75.5	304.66	1.34

**STORMWATER CONTROL MEASURE 'M' SUMMARY**

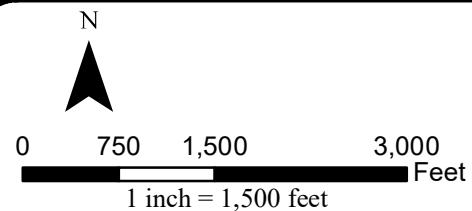
Design Drainage Area =	17.45	ac
Design Impervious Area =	7.45	ac
% Impervious =	42.7%	
Top of Dam =	346.00	ft
NWSE =	340.00	ft
WQv Ponding Elevation =	341.05	ft
Required Main Pool Surface Area at NWSE =	12,034	sf
Total Surface Area Provided at NWSE =	25,355	sf
Estimate of Provided Main Pool Surface Area at NWSE =	20,284	sf
<b>*Assume main pool 80% of total normal pool area</b>		
WQv Orifice Diameter =	3.00	in
WQv Orifice Invert Elevation =	340.00	ft
Riser Size =	5' x 5'	
Riser Crest =	344.00	ft
Barrel Diameter =	24	in
# of Barrels =	1	
Upstream Invert =	338.50	ft
Downstream Invert =	338.00	ft
Length =	50	ft
Slope =	0.0100	ft/ft

**STORMWATER CONTROL MEASURE 'M' ROUTING RESULTS**

Return Period	Inflow [cfs]	Outflow [cfs]	Max. WSE [ft]	Freeboard [ft]
1-Year	29.0	0.3	341.79	4.21
10-Year	70.6	1.7	344.06	1.94
25-Year	86.6	8.1	344.25	1.75
100-Year	110.2	31.9	344.65	1.35

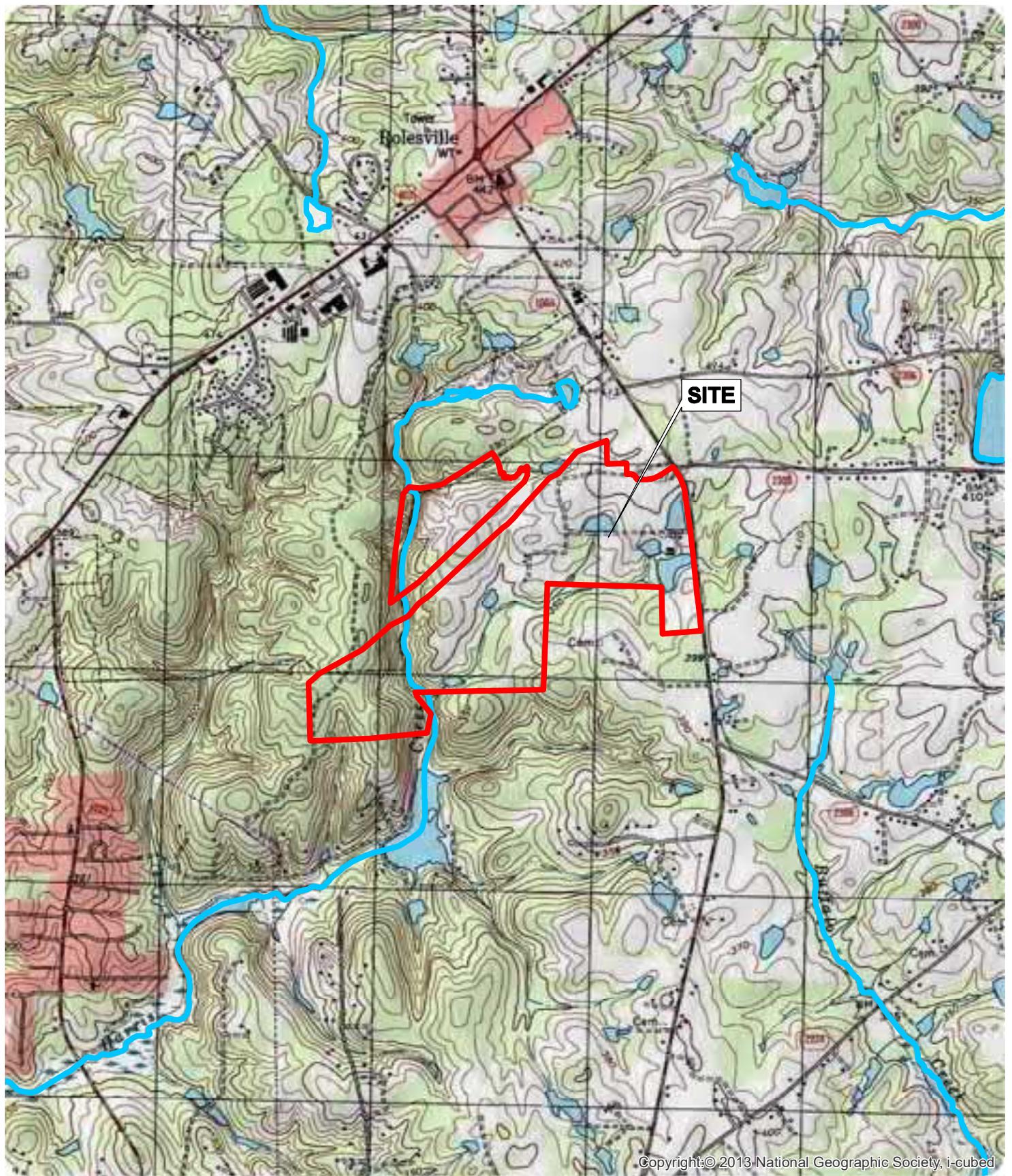
## *MISCELLANEOUS SITE INFORMATION*

**The Point**  
AWH-20000



**THE POINT**  
**SITE AERIAL MAP**  
**PROJECT #: AWH-20000**  
ROLESVILLE, NORTH CAROLINA





0 1,000 2,000 4,000  
Feet  
1 inch = 2,000 feet

**THE POINT**  
**USGS TOPO MAP**  
**PROJECT #: AWH-20000**  
**ROLESVILLE, NORTH CAROLINA**

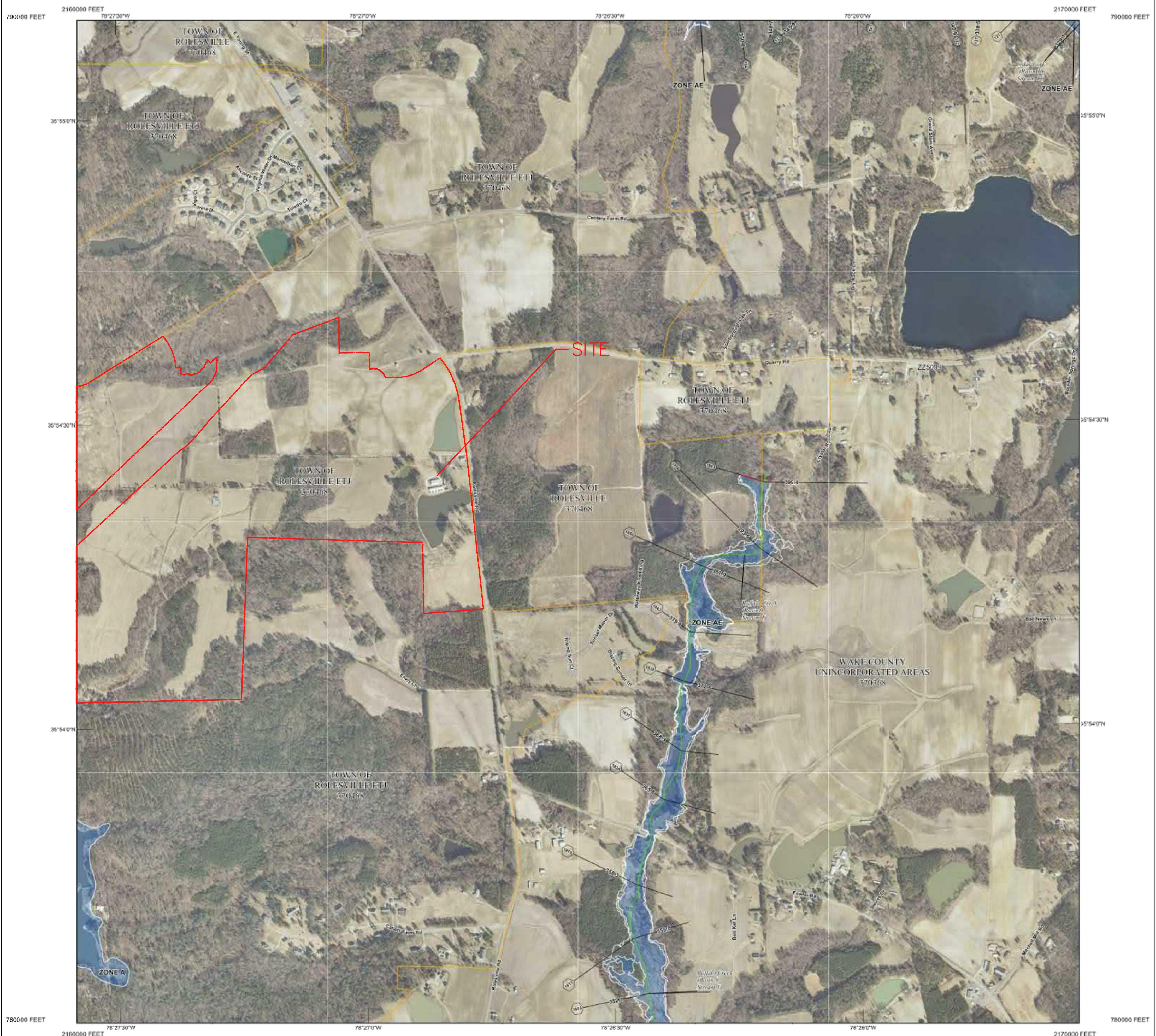


**MCADAMS**

.0315

## NEUSE RIVER BASIN

Name of Stream	Description	Class	Class Date	Index No.
NEUSE RIVER	From a point 0.5 mile upstream of Town of Wake Forest proposed water supply intake to Town of Wake Forest proposed water supply intake	WS-IV;NSW,CA	07/01/04	27-(22)
NEUSE RIVER	From Town of Wake Forest proposed water supply intake to mouth of Beddingfield Creek	C;NSW	08/03/92	27-(22.5)
Smith Creek	From source to a point 0.3 mile downstream of Franklin-Wake County Line	WS-II;HQW,NSW	08/03/92	27-23-(1)
Smith Creek (Wake Forest Reservoir)	From a point 0.3 mile downstream of Franklin-Wake County Line to dam at Wake Reservoir	WS-II;HQW,NSW, CA	08/03/92	27-23-(1.5)
Smith Creek	From dam at Wake Forest Reservoir to Neuse River	C;NSW	05/01/88	27-23-(2)
Austin Creek (Mitchell Pond)	From source to Smith Creek	C;NSW	07/01/96	27-23-3
Hatters Branch	From source to Smith Creek	C;NSW	05/01/88	27-23-4
Spring Branch	From source to Hatters Branch	C;NSW	05/01/88	27-23-4-1
Sanford Creek	From source to Smith Creek	C;NSW	05/01/88	27-23-5
Toms Creek (Mill Creek)	From source to Neuse River	C;NSW	05/01/88	27-24
Perry Creek (Greshams Lake)	From source to dam at Greshams Lake	B;NSW	05/01/88	27-25-(1)
Perry Creek	From dam at Greshams Lake to Neuse River	C;NSW	05/01/88	27-25-(2)
Unnamed Tributary near Neuse	From source to dam at Camp Durant	B;NSW	05/01/88	27-25-3-(1)
Unnamed Tributary near Neuse	From dam at Camp Durant to Perry Creek	C;NSW	05/01/88	27-25-3-(2)
<b>Harris Creek (Peeples Creek) (Wake Crossroads Lake)</b>	<b>From source to Neuse River</b>	<b>C;NSW</b>	<b>05/01/88</b>	<b>27-26</b>
Hodges Mill Creek (Lake Mirl)	From source to water intake at Lake Mirl	B;NSW	05/01/88	27-26-1-(1)
Hodges Mill Creek	From water intake at Lake Mirl to Harris Creek	C;NSW	05/01/88	27-26-1-(2)
Beaverdam Creek (west side of Neuse River)	From source to Neuse River	C;NSW	05/01/88	27-27
Rocky Creek	From source to Neuse River	C;NSW	05/01/88	27-28
Beaverdam Creek (east side of Neuse River) (Neuseco Lake, Beaverdam Lake)	From soruce to Neuse River	C;NSW	05/01/88	27-29
Bridges Creek (Bridges Lake)	From source to Neuse River	C;NSW	05/01/88	27-30
Milburnie Creek (Milburnie Lake)	From source to Neuse River	C;NSW	05/01/88	27-31
Mango Creek	From source to Neuse River	C;NSW	05/01/88	27-32
Crabtree Creek	From source to backwaters of Crabtree Lake	C;NSW	05/01/88	27-33-(1)
Turkey Creek	From source to Crabtree Creek	C;NSW	05/01/88	27-33-2
Coles Branch	From source to Crabtree Creek	C;NSW	05/01/88	27-33-3
South Fork Coles Branch	From source to Coles Branch	C;NSW	05/01/88	27-33-3-1
Crabtree Creek (Crabtree Lake)	From backwaters of Crabtree Lake to mouth of Richlands Creek	B;NSW	04/01/94	27-33-(3.5)



This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative agreement between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach to floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map all flood areas at the 1% level. As a part of this effort, the State of North Carolina has joined in a Cooperating Technical State agreement with FEMA to produce and maintain this digital FIRM.

## FLOOD HAZARD INFORMATION

**SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP**  
**THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT**  
[HTTP://FRIS.NC.GOV/FRIS](http://FRIS.NC.GOV/FRIS)

**SPECIAL FLOOD HAZARD AREAS**  
Without Base Flood Elevation (BFE)  
Zone A, A99  
With BFE or Depth Zone AE, AO, AH, VE, AR  
Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**  
0.2% Annual Chance Flood Hazard, Areas of 1% Annual Chance Flood with Average Depth Less Than One Foot or With Drainage Areas of Less Than One Square Mile Zone X  
Future Conditions 1% Annual Chance Flood Hazard Zone X  
Area with Reduced Flood Risk due to Levee See Notes Zone X

**GENERAL STRUCTURES**  
Areas Determined to be Outside the 0.2% Annual Chance Floodplain Zone X  
Channel, Culvert, or Storm Sewer  
Accredited or Provisionally Accredited Levee, Dike, or Floodwall  
Non-accredited Levee, Dike, or Floodwall

BM5510 ×  
BM5510 ⊗  
BM5510 ◊  
Contractor Est. NCFMP Survey bench mark

012-18-2  
Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)

8  
Coastal Transect

-----  
Coastal Transect Baseline

-----  
Profile Baseline

-----  
Hydrographic Feature

-----  
Limit of Study

-----  
Jurisdiction Boundary

## NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at <http://msc.fema.gov>. An accompanying Flood Insurance Study report, Letter of Map Revision (LOMR) or Letter of Map Amendment (LOMA) revising portions of this panel, and digital versions of this FIRM may be found online. Visit the North Carolina Floodplain Mapping Program website at <http://www.ncfloodmaps.com>, or contact the FEMA Map Service Center.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM index. These may be ordered directly from the Map Service Center at the number listed above.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by the North Carolina Floodplain Mapping Program (NCFMP). The source of this information can be determined from the metadata available in the digital FLOOD database and in the Technical Support Data Notebook (TSN).

**ACCREDITED LEVEE NOTES TO USERS:** If an accredited levee note appears on this panel check with your local community to determine information such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan (EAP) requirements of the local regulations.

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**LIMIT OF MODERATE WAVE ACTION NOTES TO USERS:** For some coastal flooding zones the AE Zone boundary has been divided by a Limit of Moderate Wave Action (LIMA). The LIMA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between the VE Zone and the LIMA (or between the shoreline and the LIMA for areas where VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

### Limit of Moderate Wave Action (LIMA)

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) NOTE**  
 This map may include approximate boundaries of the CBRS for informational purposes only. Flood insurance is not available within CBRS areas for structures that are newly built or substantially improved on or after the date(s) indicated on the map. For more information see <http://www.floodsmart.gov/cbri/section101/section101.html>, the FIS Report, or call the U.S. Fish and Wildlife Service Customer Service Center at 1-800-344-WILD.

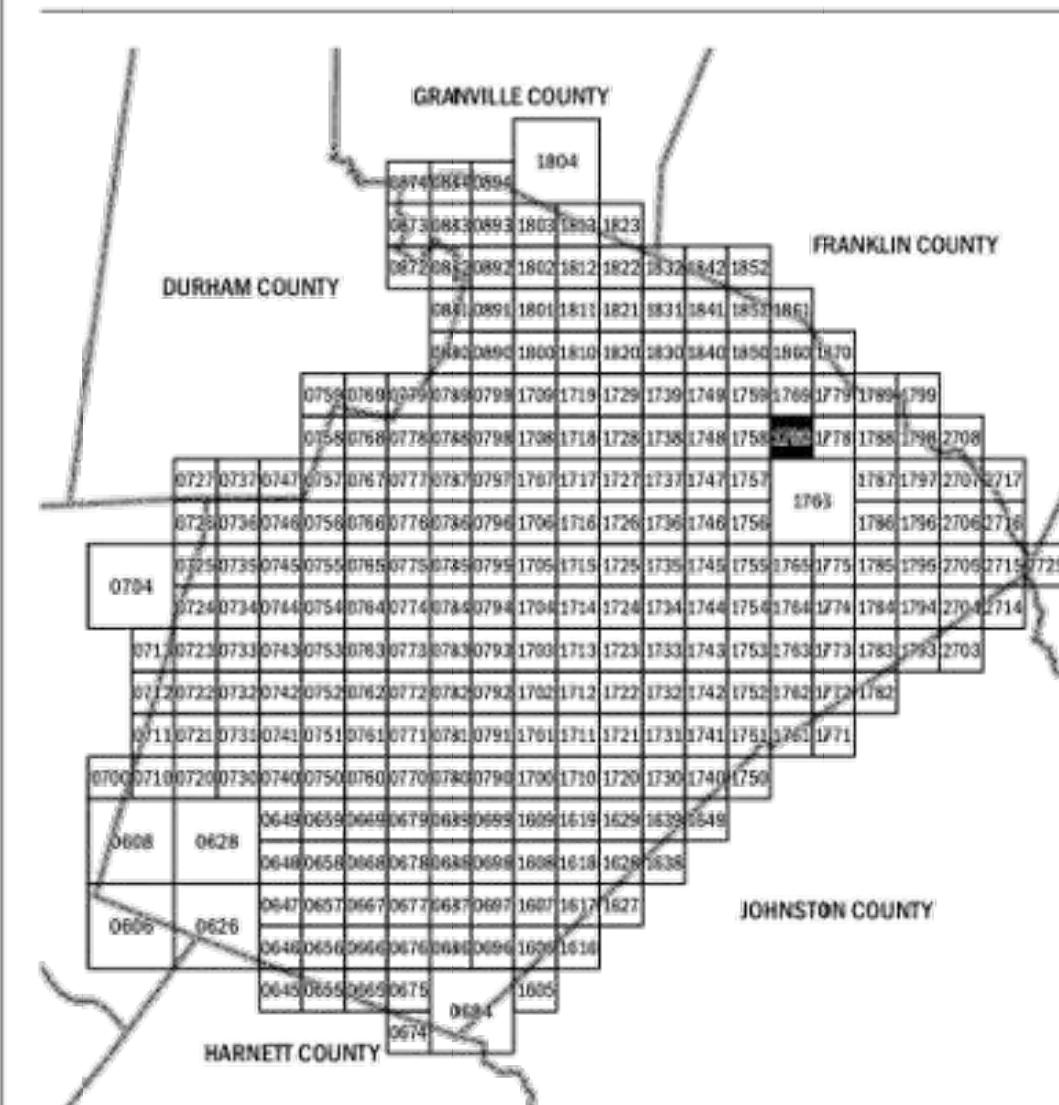
## SCALE

Map Projection:  
 North Carolina State Plane Projection Feet (Zone 3200)  
 Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

1 inch = 500 feet      1:6,000

0 250 500 1,000  
Feet  
0 75 150 300  
Meters

## PANEL LOCATOR



NORTH CAROLINA FLOODPLAIN MAPPING PROGRAM  
 NATIONAL FLOOD INSURANCE PROGRAM  
 FLOOD INSURANCE RATE MAP

NORTH CAROLINA



PANEL 1768

Panel Contains:

COMMUNITY  
 ROLESVILLE, TOWN OF  
 WAKE COUNTY

CID PANEL SUFFIX  
 370468 1768 J  
 370368 1768 J

FEMA

National Flood Insurance Program

NORTH CAROLINA



MAP NUMBER  
 3720176800J  
 MAP REVISED  
 05/02/06



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**SPECIAL FLOOD HAZARD AREAS**

- Without Base Flood Elevation (BFE)**: Zone A, A99
- With BFE or Depth**: Zone AE, AO, AH, VE, AR
- Regulatory Floodway**

**0.2% Annual Chance Flood Hazard, Areas of 1% Annual Chance Flood with Average Depth Less Than One Foot or With Drainage Areas of Less Than One Square Mile**: Zone X

**Future Conditions 1% Annual Chance Flood Hazard**: Zone X

**Area with Reduced Flood Risk due to Levee See Notes**: Zone X

**Areas Determined to be Outside the 0.2% Annual Chance Floodplain**: Zone X

**Channel, Culvert, or Storm Sewer**

**Accredited or Provisionally Accredited Levee, Dike, or Floodwall**

**Non-accredited Levee, Dike, or Floodwall**

**North Carolina Geodetic Survey bench mark**: BM5510

**National Geodetic Survey bench mark**: BM5510

**Contractor Est. NCFMP Survey bench mark**: 012-18-2

**Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)**

**Coastal Transect**

**Coastal Transect Baseline**

**Profile Baseline**

**Hydrographic Feature**

**Limit of Study**

**Jurisdiction Boundary**

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For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6820.

Base map information shown on this FIRM was provided in digital format by the North Carolina Floodplain Mapping Program (NCFMP). The source of this information can be determined from the metadata available in the digital FLOOD database and in the Technical Support Data Notebook (TSDN).

**ACCREDITED LEVEE NOTES TO USERS:** If an accredited levee note appears on this panel check with your local community to determine if information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan (EAP) for the levee system(s) is provided.

To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures.

If the community or county does not provide the necessary data and documentation or if no data and documentation provided indicates the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system.

To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures.

For more information on flood insurance, interested parties should visit the FEMA Website at <http://www.fema.gov/business/findex.html>.

**PROVISIONALLY ACCREDITED LEVEE NOTES TO USERS:** If a provisionally accredited levee (PAL) note appears on this panel, check with your local community to obtain more information, such as the estimated level of protection (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan (EAP) for the levee system(s) is provided.

To maintain accreditation, the lease owner or community is required to submit to FEMA the data and documentation of the levee system(s).

If the community or county does not provide the necessary data and documentation or if no data and documentation provided indicates the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system.

To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures.

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**Limit of Moderate Wave Action (LMWA)**

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The FIS Report or call the U.S. Fish and Wildlife Service Customer Service Center at 1-800-344-WILD.

**CBRS Area**

**Otherwise Protected Area**

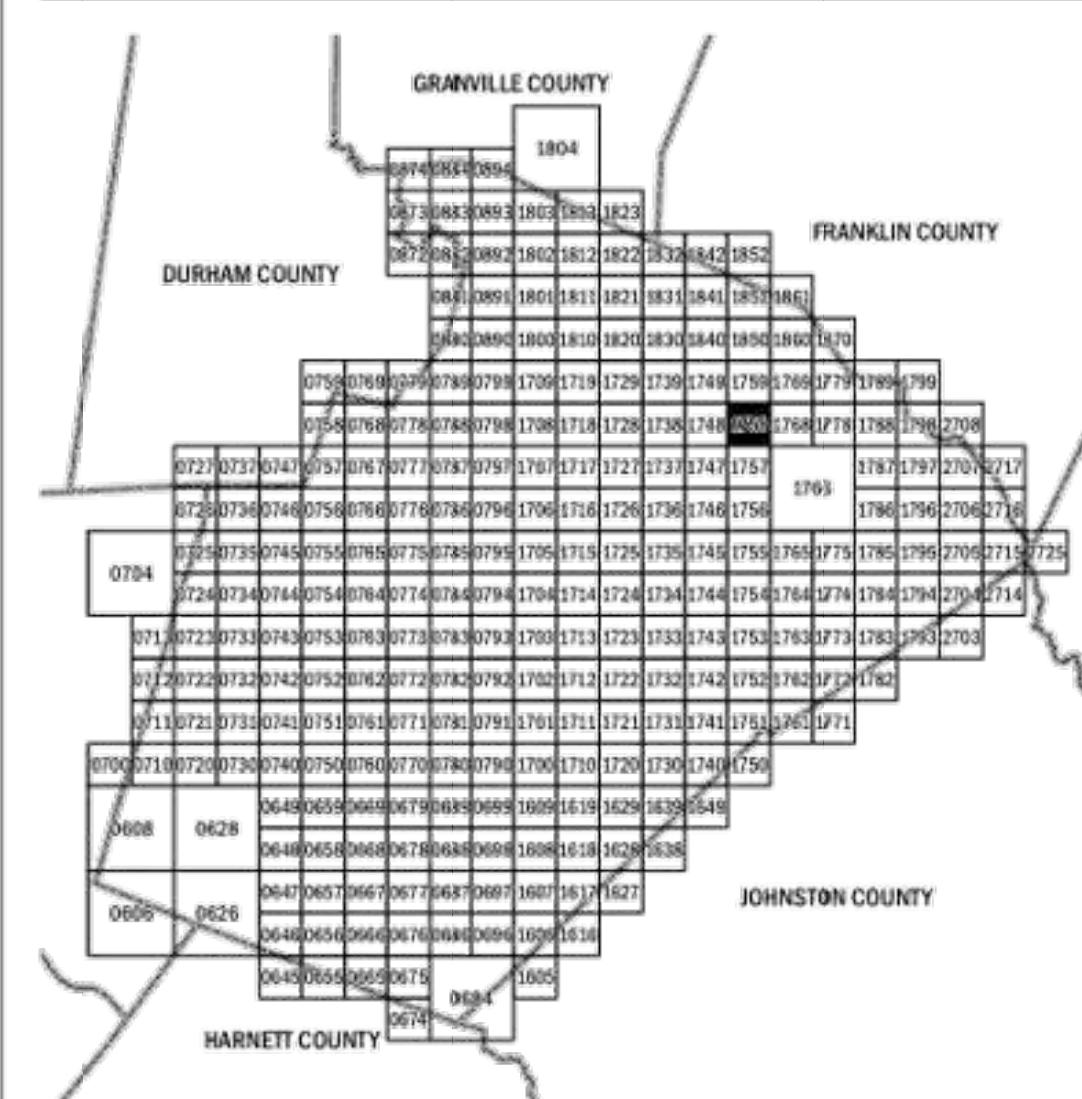
## SCALE

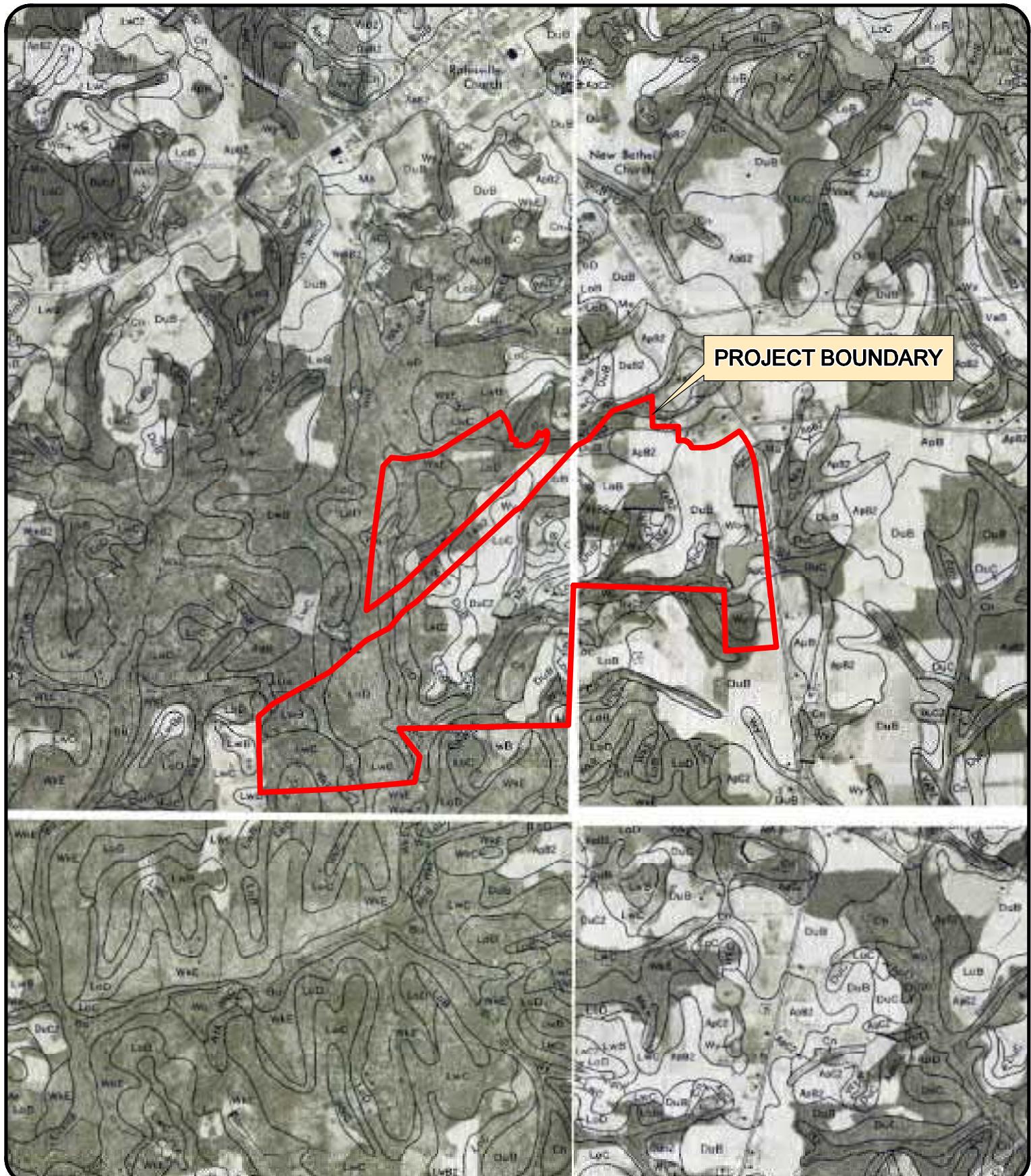
Map Projection:  
North Carolina State Plane Projection Feet (Zone 3200)  
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

1 inch = 500 feet      1:6,000

0 250 500 1,000  
Feet  
0 75 150 300  
Meters

## PANEL LOCATOR





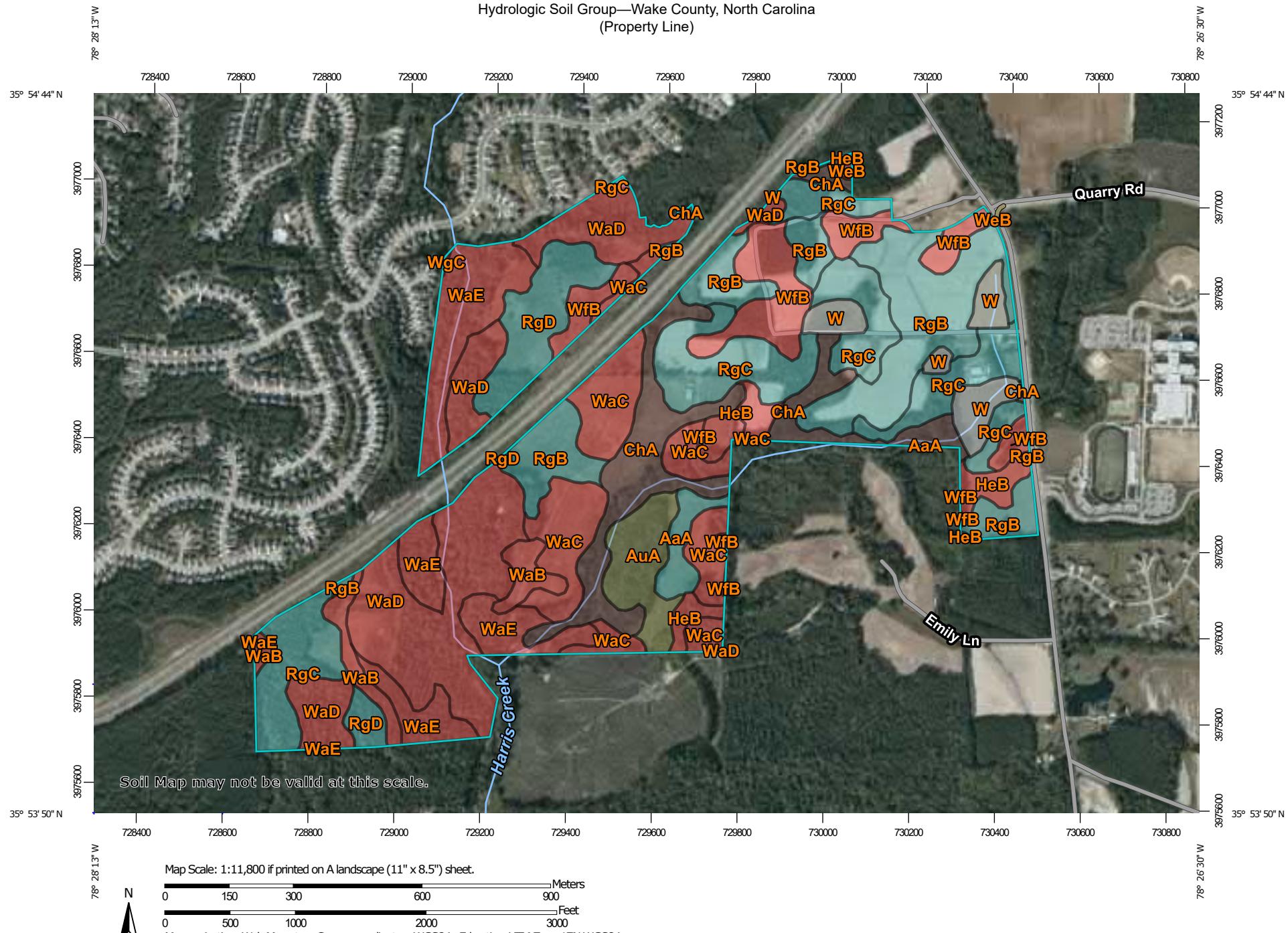
0 750 1,500 3,000  
Feet  
1 inch = 1,500 feet

**THE POINT**  
**SOIL MAP**  
**PROJECT #: AWH-20000**  
**ROLESVILLE, NORTH CAROLINA**



**McADAMS**

Hydrologic Soil Group—Wake County, North Carolina  
(Property Line)

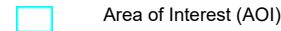


Natural Resources  
Conservation Service

Web Soil Survey  
National Cooperative Soil Survey

## MAP LEGEND

### Area of Interest (AOI)



### Soils

#### Soil Rating Polygons

	A
	A/D
	B
	B/D
	C
	C/D
	D
	Not rated or not available

#### Soil Rating Lines

	A
	A/D
	B
	B/D
	C
	C/D
	D
	Not rated or not available

#### Soil Rating Points

	A
	A/D
	B
	B/D

### C

### C/D

### D

### Not rated or not available

### Water Features

#### Streams and Canals

### Transportation

#### Rails

#### Interstate Highways

#### US Routes

#### Major Roads

#### Local Roads

### Background

#### Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Wake County, North Carolina

Survey Area Data: Version 18, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 11, 2019—Oct 19, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AaA	Altavista fine sandy loam, 0 to 4 percent slopes, rarely flooded	C	4.1	1.4%
AuA	Augusta fine sandy loam, 0 to 2 percent slopes, rarely flooded	C/D	10.1	3.3%
ChA	Chewacla and Wehadkee soils, 0 to 2 percent slopes, frequently flooded	B/D	27.0	8.9%
HeB	Helena sandy loam, 2 to 6 percent slopes	D	7.1	2.4%
RgB	Rawlings-Rion complex, 2 to 6 percent slopes	C	43.5	14.4%
RgC	Rawlings-Rion complex, 6 to 10 percent slopes	C	45.6	15.1%
RgD	Rawlings-Rion complex, 10 to 15 percent slopes	C	15.0	5.0%
W	Water		9.7	3.2%
WaB	Wake-Rolesville complex, 2 to 6 percent slopes, very rocky	D	7.4	2.4%
WaC	Wake-Rolesville complex, 6 to 10 percent slopes, very rocky	D	29.0	9.6%
WaD	Wake-Rolesville complex, 10 to 15 percent slopes, very rocky	D	51.1	16.9%
WaE	Wake-Rolesville complex, 15 to 25 percent slopes, very rocky	D	28.9	9.6%
WeB	Wedowee sandy loam, 2 to 6 percent slopes	D	0.2	0.1%
WfB	Wedowee-Saw complex, 2 to 6 percent slopes	D	22.9	7.6%
WgC	Wedowee-Urban land complex, 6 to 15 percent slopes	D	0.1	0.0%
<b>Totals for Area of Interest</b>			<b>301.6</b>	<b>100.0%</b>

## Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

**Group A.** Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

**Group B.** Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

**Group C.** Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

**Group D.** Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

**NOAA Atlas 14, Volume 2, Version 3**  
**Location name: Wake Forest, North Carolina, USA\***  
**Latitude: 35.9053°, Longitude: -78.452°**  
**Elevation: 354.67 ft\*\***



\* source: ESRI Maps

\*\* source: USGS

**POINT PRECIPITATION FREQUENCY ESTIMATES**

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aerials](#)**PF tabular**

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	<b>0.403</b> (0.369-0.442)	<b>0.468</b> (0.429-0.512)	<b>0.534</b> (0.489-0.582)	<b>0.600</b> (0.548-0.654)	<b>0.666</b> (0.606-0.726)	<b>0.718</b> (0.651-0.783)	<b>0.765</b> (0.690-0.834)	<b>0.807</b> (0.723-0.881)	<b>0.853</b> (0.758-0.932)	<b>0.895</b> (0.789-0.979)
10-min	<b>0.644</b> (0.590-0.705)	<b>0.749</b> (0.687-0.818)	<b>0.855</b> (0.783-0.933)	<b>0.959</b> (0.877-1.05)	<b>1.06</b> (0.966-1.16)	<b>1.14</b> (1.04-1.25)	<b>1.22</b> (1.10-1.33)	<b>1.28</b> (1.15-1.40)	<b>1.35</b> (1.20-1.47)	<b>1.41</b> (1.24-1.54)
15-min	<b>0.806</b> (0.738-0.882)	<b>0.942</b> (0.863-1.03)	<b>1.08</b> (0.991-1.18)	<b>1.21</b> (1.11-1.32)	<b>1.35</b> (1.22-1.47)	<b>1.45</b> (1.31-1.58)	<b>1.54</b> (1.39-1.68)	<b>1.61</b> (1.45-1.76)	<b>1.70</b> (1.51-1.86)	<b>1.77</b> (1.56-1.94)
30-min	<b>1.10</b> (1.01-1.21)	<b>1.30</b> (1.19-1.42)	<b>1.54</b> (1.41-1.68)	<b>1.76</b> (1.61-1.92)	<b>1.99</b> (1.81-2.17)	<b>2.18</b> (1.98-2.38)	<b>2.35</b> (2.12-2.57)	<b>2.51</b> (2.25-2.74)	<b>2.70</b> (2.40-2.95)	<b>2.87</b> (2.52-3.14)
60-min	<b>1.38</b> (1.26-1.51)	<b>1.63</b> (1.50-1.78)	<b>1.97</b> (1.81-2.15)	<b>2.29</b> (2.09-2.50)	<b>2.65</b> (2.42-2.89)	<b>2.96</b> (2.68-3.22)	<b>3.24</b> (2.92-3.53)	<b>3.52</b> (3.16-3.85)	<b>3.88</b> (3.45-4.24)	<b>4.18</b> (3.69-4.58)
2-hr	<b>1.61</b> (1.46-1.78)	<b>1.92</b> (1.75-2.10)	<b>2.34</b> (2.13-2.56)	<b>2.75</b> (2.49-3.01)	<b>3.23</b> (2.91-3.54)	<b>3.66</b> (3.28-4.00)	<b>4.07</b> (3.63-4.45)	<b>4.49</b> (3.98-4.91)	<b>5.04</b> (4.42-5.51)	<b>5.52</b> (4.80-6.05)
3-hr	<b>1.71</b> (1.55-1.89)	<b>2.03</b> (1.85-2.24)	<b>2.49</b> (2.26-2.74)	<b>2.94</b> (2.67-3.24)	<b>3.50</b> (3.15-3.84)	<b>3.99</b> (3.58-4.39)	<b>4.49</b> (3.98-4.92)	<b>5.00</b> (4.41-5.48)	<b>5.69</b> (4.96-6.24)	<b>6.32</b> (5.45-6.95)
6-hr	<b>2.05</b> (1.87-2.26)	<b>2.44</b> (2.23-2.68)	<b>2.99</b> (2.72-3.28)	<b>3.54</b> (3.22-3.88)	<b>4.22</b> (3.82-4.62)	<b>4.84</b> (4.35-5.29)	<b>5.46</b> (4.86-5.96)	<b>6.12</b> (5.39-6.67)	<b>7.00</b> (6.10-7.64)	<b>7.82</b> (6.72-8.55)
12-hr	<b>2.41</b> (2.21-2.66)	<b>2.87</b> (2.64-3.15)	<b>3.54</b> (3.24-3.88)	<b>4.21</b> (3.84-4.62)	<b>5.07</b> (4.59-5.53)	<b>5.85</b> (5.26-6.36)	<b>6.64</b> (5.91-7.22)	<b>7.49</b> (6.59-8.14)	<b>8.66</b> (7.50-9.41)	<b>9.76</b> (8.32-10.6)
24-hr	<b>2.86</b> (2.66-3.08)	<b>3.46</b> (3.22-3.73)	<b>4.35</b> (4.04-4.69)	<b>5.06</b> (4.69-5.44)	<b>6.02</b> (5.57-6.49)	<b>6.80</b> (6.27-7.32)	<b>7.60</b> (6.98-8.19)	<b>8.43</b> (7.71-9.09)	<b>9.58</b> (8.71-10.3)	<b>10.5</b> (9.50-11.3)
2-day	<b>3.32</b> (3.09-3.57)	<b>3.99</b> (3.72-4.30)	<b>4.98</b> (4.64-5.37)	<b>5.77</b> (5.35-6.21)	<b>6.83</b> (6.32-7.36)	<b>7.68</b> (7.09-8.27)	<b>8.56</b> (7.87-9.22)	<b>9.46</b> (8.66-10.2)	<b>10.7</b> (9.74-11.6)	<b>11.7</b> (10.6-12.7)
3-day	<b>3.52</b> (3.28-3.77)	<b>4.23</b> (3.94-4.54)	<b>5.25</b> (4.89-5.63)	<b>6.06</b> (5.64-6.50)	<b>7.17</b> (6.64-7.69)	<b>8.05</b> (7.44-8.64)	<b>8.96</b> (8.25-9.62)	<b>9.89</b> (9.07-10.6)	<b>11.2</b> (10.2-12.1)	<b>12.2</b> (11.1-13.2)
4-day	<b>3.72</b> (3.47-3.98)	<b>4.46</b> (4.17-4.77)	<b>5.52</b> (5.15-5.90)	<b>6.35</b> (5.92-6.79)	<b>7.50</b> (6.96-8.01)	<b>8.42</b> (7.79-9.00)	<b>9.36</b> (8.63-10.0)	<b>10.3</b> (9.49-11.1)	<b>11.7</b> (10.7-12.5)	<b>12.7</b> (11.6-13.7)
7-day	<b>4.31</b> (4.04-4.61)	<b>5.15</b> (4.82-5.50)	<b>6.29</b> (5.88-6.71)	<b>7.19</b> (6.72-7.68)	<b>8.43</b> (7.85-9.00)	<b>9.42</b> (8.75-10.1)	<b>10.4</b> (9.66-11.2)	<b>11.5</b> (10.6-12.3)	<b>12.9</b> (11.8-13.9)	<b>14.1</b> (12.8-15.1)
10-day	<b>4.91</b> (4.61-5.24)	<b>5.85</b> (5.48-6.23)	<b>7.04</b> (6.60-7.50)	<b>7.99</b> (7.47-8.50)	<b>9.26</b> (8.64-9.86)	<b>10.3</b> (9.55-10.9)	<b>11.3</b> (10.5-12.0)	<b>12.3</b> (11.4-13.2)	<b>13.7</b> (12.6-14.7)	<b>14.8</b> (13.6-15.9)
20-day	<b>6.59</b> (6.20-7.02)	<b>7.79</b> (7.32-8.29)	<b>9.23</b> (8.67-9.81)	<b>10.4</b> (9.72-11.0)	<b>11.9</b> (11.1-12.7)	<b>13.1</b> (12.2-14.0)	<b>14.3</b> (13.3-15.3)	<b>15.6</b> (14.5-16.6)	<b>17.3</b> (16.0-18.5)	<b>18.6</b> (17.1-19.9)
30-day	<b>8.18</b> (7.72-8.69)	<b>9.63</b> (9.08-10.2)	<b>11.2</b> (10.6-11.9)	<b>12.5</b> (11.7-13.2)	<b>14.1</b> (13.2-15.0)	<b>15.4</b> (14.4-16.3)	<b>16.6</b> (15.5-17.7)	<b>17.9</b> (16.7-19.0)	<b>19.5</b> (18.1-20.9)	<b>20.8</b> (19.3-22.3)
45-day	<b>10.4</b> (9.89-11.0)	<b>12.2</b> (11.6-12.9)	<b>14.0</b> (13.3-14.8)	<b>15.4</b> (14.6-16.2)	<b>17.2</b> (16.3-18.1)	<b>18.6</b> (17.5-19.6)	<b>19.9</b> (18.7-21.0)	<b>21.2</b> (19.9-22.5)	<b>23.0</b> (21.5-24.4)	<b>24.3</b> (22.7-25.8)
60-day	<b>12.5</b> (11.9-13.1)	<b>14.6</b> (13.9-15.4)	<b>16.6</b> (15.7-17.4)	<b>18.1</b> (17.1-19.0)	<b>20.0</b> (19.0-21.1)	<b>21.5</b> (20.3-22.6)	<b>22.9</b> (21.6-24.1)	<b>24.2</b> (22.9-25.6)	<b>26.0</b> (24.5-27.5)	<b>27.4</b> (25.7-29.0)

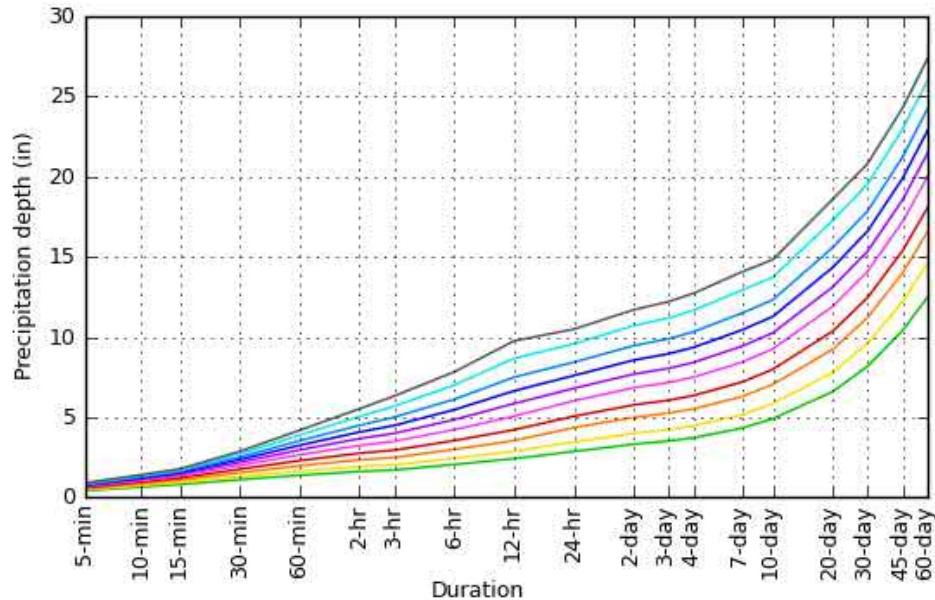
<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

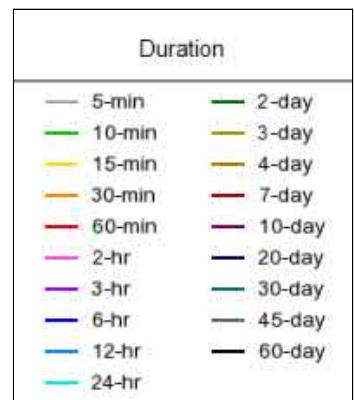
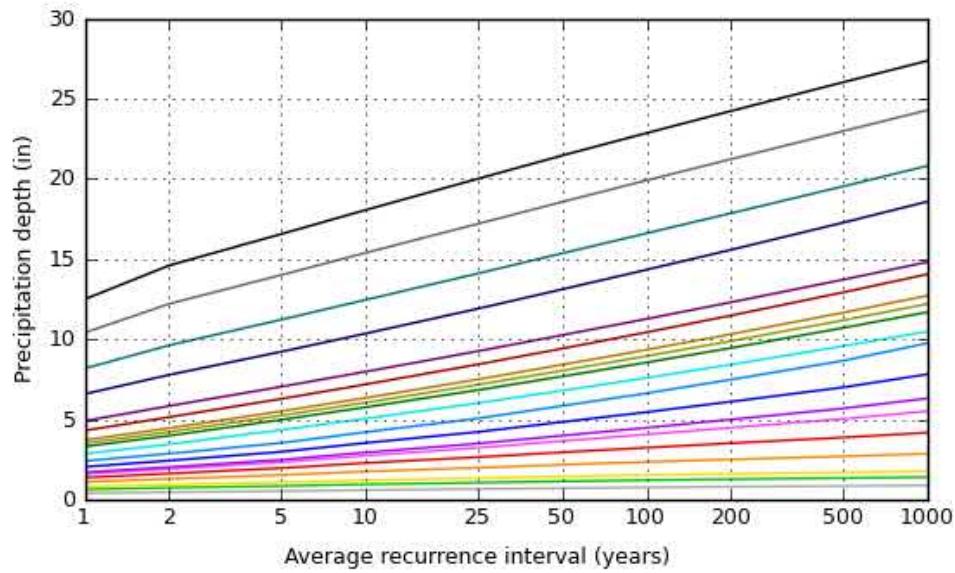
Please refer to NOAA Atlas 14 document for more information.

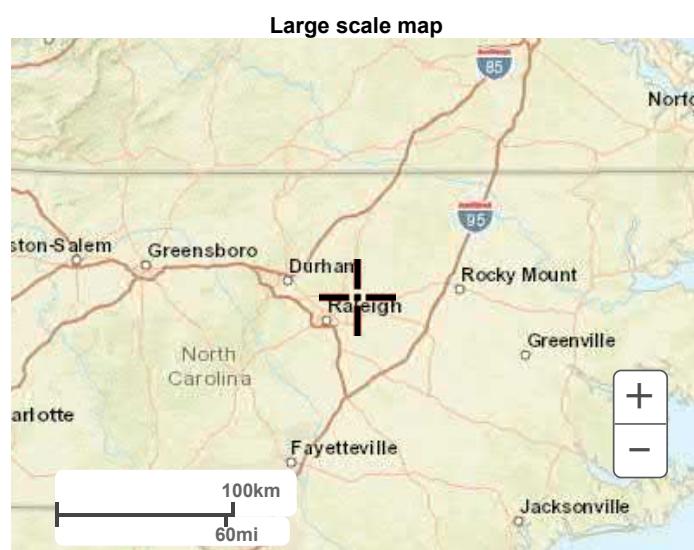
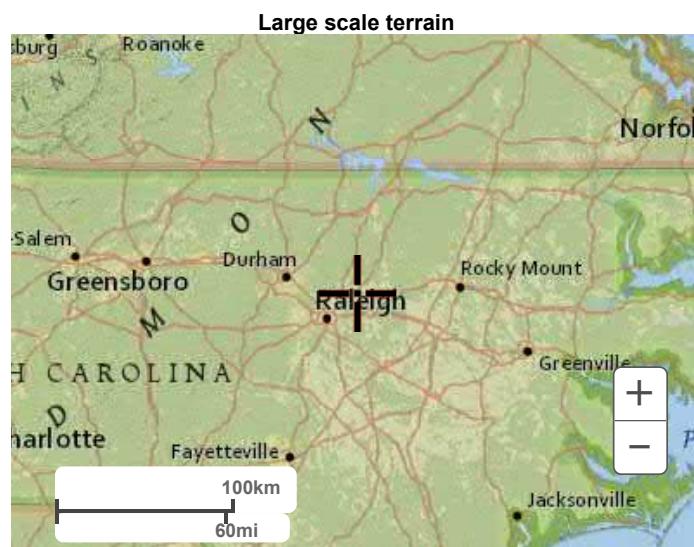
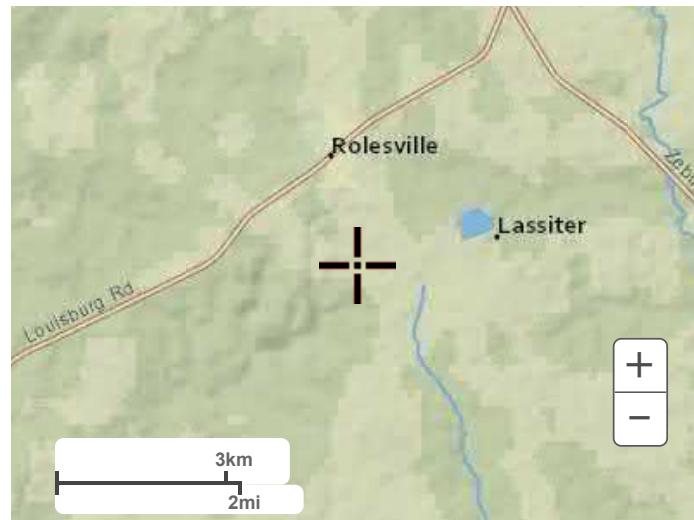
[Back to Top](#)**PF graphical**

PDS-based depth-duration-frequency (DDF) curves  
Latitude: 35.9053°, Longitude: -78.4520°

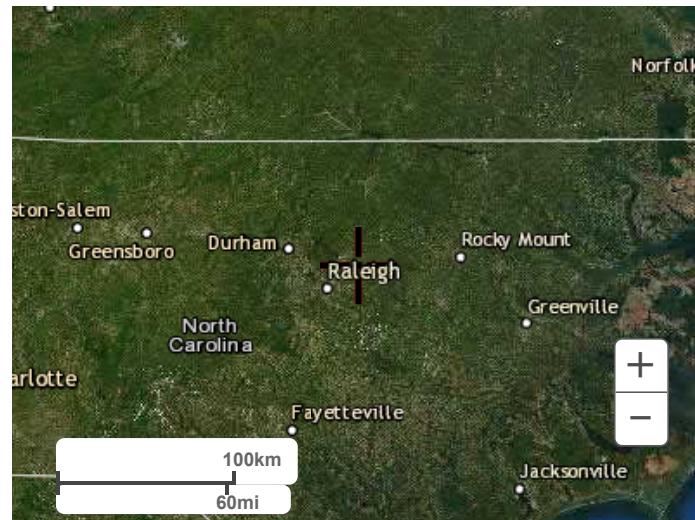


Average recurrence interval (years)
1
2
5
10
25
50
100
200
500
1000

**Maps & aerials****Small scale terrain**



Large scale aerial



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*PRE-DEVELOPMENT  
HYDROLOGIC CALCULATIONS*

The Point  
AWH-20000

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Total Area (ac)
Crops	B	78	Yes	0	0.00	23.79
Crops	B/D	89	Yes	0	0.00	0.13
Crops	D	89	Yes	0	0.00	6.70
Low Density Residential	B	68		20	0.06	0.29
Low Density Residential	D	84		20	4.53	22.63
Medium Density Residential	B	70		25	0.29	1.14
Medium Density Residential	D	85		25	0.02	0.08
Mixed Use Neighborhood	B	85		65	9.26	14.25
Mixed Use Neighborhood	B/D	92		65	2.68	4.12
Mixed Use Neighborhood	C	90		65	1.16	1.79
Mixed Use Neighborhood	D	92		65	10.60	16.30
Open	B	61	Yes	0	0.00	16.63
Open	B/D	80	Yes	0	0.00	0.38
Open	D	80	Yes	0	0.00	8.88
Pond	B	100	Yes	0	0.00	0.13
Pond	B/D	100	Yes	0	0.00	0.02
Pond	D	100	Yes	0	0.00	6.78
Roadway		98		100	7.98	7.98
Roof	B	98	Yes	100	0.35	0.35
Roof	D	98	Yes	100	0.00	0.00
School	B	88		72	12.90	17.91
School	B/D	93		72	6.11	8.49
School	D	93		72	43.84	60.89
Trail	B	82	Yes	100	0.52	0.52
Trail	B/D	89	Yes	100	0.01	0.01
Trail	D	89	Yes	100	0.11	0.11
Wooded	B	55	Yes	0	0.00	8.52
Wooded	B/D	77	Yes	0	0.00	6.40
Wooded	C	70	Yes	0	0.00	0.03
Wooded	D	77	Yes	0	0.00	1.61
<b>Total Area</b>		<b>236.88 ac</b>				
<b>Total Impervious Area</b>		<b>100.42 ac</b>				
<b>Onsite Area</b>		<b>81.00 ac</b>				
<b>Onsite Impervious Area</b>		<b>0.99 ac</b>				
<b>Percent Impervious</b>		<b>42 %</b>				
<b>Composite Curve Number</b>		<b>89</b>				

**Time of Concentration Information**

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

**Segment 1: Overland Flow**

Length =	100	ft
Top Elev =	426.00	ft
Bot Elev =	425.00	ft
Height =	1	ft
Slope =	0.0100	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>13.74</b>	<b>minutes</b>

**Segment 2: Concentrated Flow**

Length =	2645	ft
Top Elev =	425.00	ft
Bot Elev =	374.00	ft
Height =	51	ft
Slope =	0.0193	ft/ft
Paved ? =	No	
Velocity =	2.24	ft/sec
<b>Segment Time =</b>	<b>19.68</b>	<b>minutes</b>

**Segment 3: Open Water Flow**

Length =	580	ft
Top Elev =	374.00	ft
Bot Elev =	372.00	ft
<b>Segment Time =</b>	<b>0.00</b>	<b>minutes</b>

**Segment 4: Channel Flow**

Length =	2088	ft
Top Elev =	372.00	ft
Bot Elev =	344.00	ft
Height =	28	ft
Slope =	0.0134	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	4.72	ft/sec
<b>Segment Time =</b>	<b>7.38</b>	<b>minutes</b>

Time of Concentration =	40.80	minutes
SCS Lag Time =	24.48	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	7.10	minutes (= 0.29 * SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Crops	B	78	Yes	0	0.00	1.34
Crops	D	89	Yes	0	0.00	0.55
Low Density Residential	D	84		20	3.59	17.96
Mixed Use Neighborhood	B	85		65	3.44	5.30
Mixed Use Neighborhood	B/D	92		65	0.58	0.89
Mixed Use Neighborhood	D	92		65	8.11	12.48
Open	B	61	Yes	0	0.00	0.92
Open	D	80	Yes	0	0.00	0.75
Roadway		98		100	13.35	13.35
Trail	B	82	Yes	100	0.07	0.07
Trail	D	89	Yes	100	0.22	0.22
Wooded	B	55	Yes	0	0.00	2.53
Wooded	B/D	77	Yes	0	0.00	1.21
Wooded	D	77	Yes	0	0.00	2.33
<b>Total Area</b>		<b>59.90 ac</b>				
<b>Total Impervious Area</b>		<b>29.36 ac</b>				
<b>Onsite Area</b>		<b>9.92 ac</b>				
<b>Onsite Impervious Area</b>		<b>0.28 ac</b>				
<b>Percent Impervious</b>		<b>49 %</b>				
<b>Composite Curve Number</b>		<b>87</b>				

#### Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

##### **Segment 1: Overland Flow**

Length =	100	ft
Top Elev =	427.00	ft
Bot Elev =	426.00	ft
Height =	1	ft
Slope =	0.0100	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>13.74</b>	<b>minutes</b>

##### **Segment 2: Concentrated Flow**

Length =	2541	ft
Top Elev =	426.00	ft
Bot Elev =	368.00	ft
Height =	58	ft
Slope =	0.0228	ft/ft
Paved ? =	No	
Velocity =	2.44	ft/sec
<b>Segment Time =</b>	<b>17.37</b>	<b>minutes</b>

Time of Concentration =	31.12	minutes
SCS Lag Time =	18.67	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	5.41	minutes (= 0.29 * SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Open	C	74	Yes	0	0.00	1.23
Open	D	80	Yes	0	0.00	1.45
Wooded	C	70	Yes	0	0.00	0.85
Wooded	D	77	Yes	0	0.00	4.59
<b>Total Area</b>		<b>8.11 ac</b>				
<b>Total Impervious Area</b>		<b>0.00 ac</b>				
<b>Onsite Area</b>		<b>8.11 ac</b>				
<b>Onsite Impervious Area</b>		<b>0.00 ac</b>				
<b>Percent Impervious</b>		<b>0 %</b>				
<b>Composite Curve Number</b>		<b>76</b>				

#### Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

##### **Segment 1: Overland Flow**

Length =	100	ft
Top Elev =	368.00	ft
Bot Elev =	363.00	ft
Height =	5	ft
Slope =	0.0500	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>9.51</b>	<b>minutes</b>

##### **Segment 2: Concentrated Flow**

Length =	881	ft
Top Elev =	363.00	ft
Bot Elev =	336.00	ft
Height =	27	ft
Slope =	0.0306	ft/ft
Paved ? =	No	
Velocity =	2.82	ft/sec
<b>Segment Time =</b>	<b>5.20</b>	<b>minutes</b>

##### **Segment 3: Channel Flow**

Length =	249	ft
Top Elev =	336.00	ft
Bot Elev =	333.00	ft
Height =	3	ft
Slope =	0.0120	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	4.47	ft/sec
<b>Segment Time =</b>	<b>0.93</b>	<b>minutes</b>

<b>Time of Concentration =</b>	<b>15.64</b>	<b>minutes</b>
<b>SCS Lag Time =</b>	<b>9.38</b>	<b>minutes (SCS Lag = 0.6* Tc)</b>
<b>Time Increment =</b>	<b>2.72</b>	<b>minutes (= 0.29*SCS Lag)</b>

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Crops	B	78	Yes	0	0.00	6.35
Crops	B/D	89	Yes	0	0.00	0.16
Crops	D	89	Yes	0	0.00	3.19
Mixed Use Neighborhood	B	85		65	1.18	1.82
Mixed Use Neighborhood	B/D	92		65	0.56	0.86
Mixed Use Neighborhood	C	90		65	0.68	1.04
Mixed Use Neighborhood	D	92		65	5.08	7.81
Open	A	39	Yes	0	0.00	1.44
Open	B	61	Yes	0	0.00	10.63
Open	B/D	80	Yes	0	0.00	8.78
Open	C	74	Yes	0	0.00	4.91
Open	D	80	Yes	0	0.00	20.40
Roadway		98		100	7.47	7.47
Roof	B	98	Yes	100	0.11	0.11
Roof	B/D	98	Yes	100	0.00	0.00
Roof	D	98	Yes	100	0.03	0.03
Trail	A	72	Yes	100	0.17	0.17
Trail	B	82	Yes	100	0.39	0.39
Trail	B/D	89	Yes	100	0.19	0.19
Trail	D	89	Yes	100	0.69	0.69
Wooded	A	30	Yes	0	0.00	0.00
Wooded	B	55	Yes	0	0.00	3.07
Wooded	B/D	77	Yes	0	0.00	9.47
Wooded	C	70	Yes	0	0.00	7.15
Wooded	D	77	Yes	0	0.00	12.43
<b>Total Area</b>		<b>108.57 ac</b>				
<b>Total Impervious Area</b>		<b>16.56 ac</b>				
<b>Onsite Area</b>		<b>89.56 ac</b>				
<b>Onsite Impervious Area</b>		<b>1.59 ac</b>				
<b>Percent Impervious</b>		<b>15 %</b>				
<b>Composite Curve Number</b>		<b>78</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

**Segment 1: Overland Flow**

Length =	100	ft
Top Elev =	389.00	ft
Bot Elev =	388.00	ft
Height =	1	ft
Slope =	0.0100	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>13.74</b>	<b>minutes</b>

**Segment 2: Concentrated Flow**

Length =	1855	ft
Top Elev =	388.00	ft
Bot Elev =	339.00	ft
Height =	49	ft
Slope =	0.0264	ft/ft
Paved ? =	No	
Velocity =	2.62	ft/sec
<b>Segment Time =</b>	<b>11.79</b>	<b>minutes</b>

**Segment 3: Channel Flow**

Length =	2366	ft
Top Elev =	339.00	ft
Bot Elev =	302.00	ft
Height =	37	ft
Slope =	0.0156	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	5.09	ft/sec
<b>Segment Time =</b>	<b>7.74</b>	<b>minutes</b>

<b>Time of Concentration =</b>	33.28	minutes
<b>SCS Lag Time =</b>	19.97	minutes (SCS Lag = 0.6* Tc)
<b>Time Increment =</b>	5.79	minutes (= 0.29*SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Business Park	A	89		85	0.01	0.01
Business Park	B	92		85	0.02	0.02
Business Park	D	95		85	0.03	0.03
Commercial	D	95		85	0.86	1.01
High Density Residential	B	85		65	46.03	70.82
High Density Residential	D	92		65	33.44	51.45
Low Density Residential	B	65		20	0.18	0.92
Low Density Residential	D	82		20	0.37	1.85
Medium Density Residential	A	54		25	0.00	0.01
Medium Density Residential	B	70		25	11.98	47.92
Medium Density Residential	D	85		25	10.74	42.98
Mixed Use Neighborhood	B	85		65	4.36	6.71
Mixed Use Neighborhood	B/D	92		65	2.15	3.31
Mixed Use Neighborhood	D	92		65	7.50	11.55
Open	A	49	Yes	0	0.00	1.90
Open	B	69	Yes	0	0.00	10.33
Open	D	84	Yes	0	0.00	11.86
Preserved Open Space	A	39		0	0.00	0.39
Preserved Open Space	B	61		0	0.00	4.48
Preserved Open Space	D	80		0	0.00	34.05
Roadway		98		100	49.05	49.05
School	B	88		72	0.34	0.47
School	D	93		72	5.12	7.11
Town Center	B	92		85	5.55	6.53
Town Center	D	95		85	1.48	1.74
Trail	A	72	Yes	100	0.02	0.02
Trail	B	82	Yes	100	0.43	0.43
Trail	D	89	Yes	100	1.93	1.93
Wooded	A	30	Yes	0	0.00	0.70
Wooded	B	55	Yes	0	0.00	4.50
Wooded	B/D	77	Yes	0	0.00	0.15
Wooded	D	77	Yes	0	0.00	50.68
<b>Total Area</b>		<b>424.89 ac</b>				
<b>Total Impervious Area</b>		<b>181.60 ac</b>				
<b>Onsite Area</b>		<b>82.49 ac</b>				
<b>Onsite Impervious Area</b>		<b>2.38 ac</b>				
<b>Percent Impervious</b>		<b>43 %</b>				
<b>Composite Curve Number</b>		<b>84</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

**Segment 1: Overland Flow**

Length =	100	ft
Top Elev =	440.00	ft
Bot Elev =	438.00	ft
Height =	2	ft
Slope =	0.0200	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>13.72</b>	<b>minutes</b>

**Segment 2: Concentrated Flow**

Length =	2989	ft
Top Elev =	438.00	ft
Bot Elev =	372.00	ft
Height =	66	ft
Slope =	0.0221	ft/ft
Paved ? =	No	
Velocity =	2.40	ft/sec
<b>Segment Time =</b>	<b>20.78</b>	<b>minutes</b>

**Segment 3: Open Water Flow**

Length =	655	ft
Top Elev =	372.00	ft
Bot Elev =	372.00	ft
<b>Segment Time =</b>	<b>0.00</b>	<b>minutes</b>

**Segment 4: Concentrated Flow**

Length =	2379	ft
Top Elev =	372.00	ft
Bot Elev =	320.00	ft
Height =	52	ft
Slope =	0.0219	ft/ft
Paved ? =	No	
Velocity =	2.39	ft/sec
<b>Segment Time =</b>	<b>16.62</b>	<b>minutes</b>

**Segment 5: Channel Flow**

Length =	3730	ft
Top Elev =	320.00	ft
Bot Elev =	292.00	ft
Height =	28	ft
Slope =	0.0075	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	32.00	sf (assume 8'w x 4'h channel)
Wetted Perimeter =	16.00	lf (assume 8'w x 4'h channel)
Channel Velocity =	4.55	ft/sec
<b>Segment Time =</b>	<b>13.65</b>	<b>minutes</b>

<b>Time of Concentration =</b>	48.15	minutes
<b>SCS Lag Time =</b>	28.89	minutes (SCS Lag = 0.6* Tc)
<b>Time Increment =</b>	8.38	minutes (= 0.29*SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Trail	D	89	Yes	100	0.16	0.16
Wooded	A	30	Yes	0	0.00	0.37
Wooded	D	77	Yes	0	0.00	8.04
<b>Total Area</b>	<b>8.56 ac</b>					
<b>Total Impervious Area</b>	<b>0.16 ac</b>					
<b>Onsite Area</b>	<b>8.56 ac</b>					
<b>Onsite Impervious Area</b>	<b>0.16 ac</b>					
<b>Percent Impervious</b>	<b>2 %</b>					
<b>Composite Curve Number</b>	<b>75</b>					

#### Time of Concentration Information

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

##### *Segment 1: Overland Flow*

Length = 100 ft  
 Top Elev = 386.00 ft  
 Bot Elev = 380.00 ft  
 Height = 6 ft  
 Slope = 0.0600 ft/ft  
 Manning's n = 0.40 wooded  
 P (2-year/24-hour) = 3.46 inches (Rolesville, NC)  
**Segment Time = 13.31 minutes**

##### *Segment 2: Concentrated Flow*

Length = 599 ft  
 Top Elev = 380.00 ft  
 Bot Elev = 288.00 ft  
 Height = 92 ft  
 Slope = 0.1536 ft/ft  
 Paved ? = No  
 Velocity = 6.32 ft/sec  
**Segment Time = 1.58 minutes**

<b>Time of Concentration =</b>	14.89	minutes
<b>SCS Lag Time =</b>	8.93	minutes (SCS Lag = 0.6* Tc)
<b>Time Increment =</b>	2.59	minutes (= 0.29*SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Open	A	39	Yes	0	0.00	0.70
Open	B	61	Yes	0	0.00	1.00
Open	D	80	Yes	0	0.00	0.06
Trail	B	82	Yes	100	0.15	0.15
Wooded	A	30	Yes	0	0.00	0.66
Wooded	B	55	Yes	0	0.00	7.85
Wooded	D	77	Yes	0	0.00	5.24
<b>Total Area</b>		<b>15.67 ac</b>				
<b>Total Impervious Area</b>		<b>0.15 ac</b>				
<b>Onsite Area</b>		<b>15.67 ac</b>				
<b>Onsite Impervious Area</b>		<b>0.15 ac</b>				
<b>Percent Impervious</b>		<b>1 %</b>				
<b>Composite Curve Number</b>		<b>61</b>				

#### Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

##### *Segment 1: Overland Flow*

Length = 100 ft  
 Top Elev = 418.00 ft  
 Bot Elev = 417.00 ft  
 Height = 1 ft  
 Slope = 0.0100 ft/ft  
 Manning's n = 0.24 dense grasses  
 P (2-year/24-hour) = 3.46 inches (Rolesville, NC)  
**Segment Time = 18.11 minutes**

##### *Segment 2: Concentrated Flow*

Length = 591 ft  
 Top Elev = 417.00 ft  
 Bot Elev = 338.00 ft  
 Height = 79 ft  
 Slope = 0.1337 ft/ft  
 Paved ? = No  
 Velocity = 5.90 ft/sec  
**Segment Time = 1.67 minutes**

##### *Segment 3: Channel Flow*

Length = 285 ft  
 Top Elev = 338.00 ft  
 Bot Elev = 324.00 ft  
 Height = 14 ft  
 Slope = 0.0491 ft/ft  
 Manning's n = 0.045 natural channel  
 Flow Area = 10.00 sf (assume 5'w x 2'h channel)  
 Wetted Perimeter = 9.00 lf (assume 5'w x 2'h channel)  
 Channel Velocity = 7.87 ft/sec  
**Segment Time = 0.60 minutes**

<b>Time of Concentration =</b>	20.38	minutes
<b>SCS Lag Time =</b>	12.23	minutes (SCS Lag = 0.6* Tc)
<b>Time Increment =</b>	3.55	minutes (= 0.29*SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Open	A	39	Yes	0	0.00	0.67
Open	B	61	Yes	0	0.00	1.24
Open	D	80	Yes	0	0.00	0.02
Trail	A	72	Yes	100	0.04	0.04
Trail	B	82	Yes	100	0.07	0.07
Wooded	A	30	Yes	0	0.00	0.71
Wooded	B	55	Yes	0	0.00	3.22
Wooded	D	77	Yes	0	0.00	0.26
<b>Total Area</b>		<b>6.23 ac</b>				
<b>Total Impervious Area</b>		<b>0.11 ac</b>				
<b>Onsite Area</b>		<b>6.23 ac</b>				
<b>Onsite Impervious Area</b>		<b>0.11 ac</b>				
<b>Percent Impervious</b>		<b>2 %</b>				
<b>Composite Curve Number</b>		<b>53</b>				

#### Time of Concentration Information

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

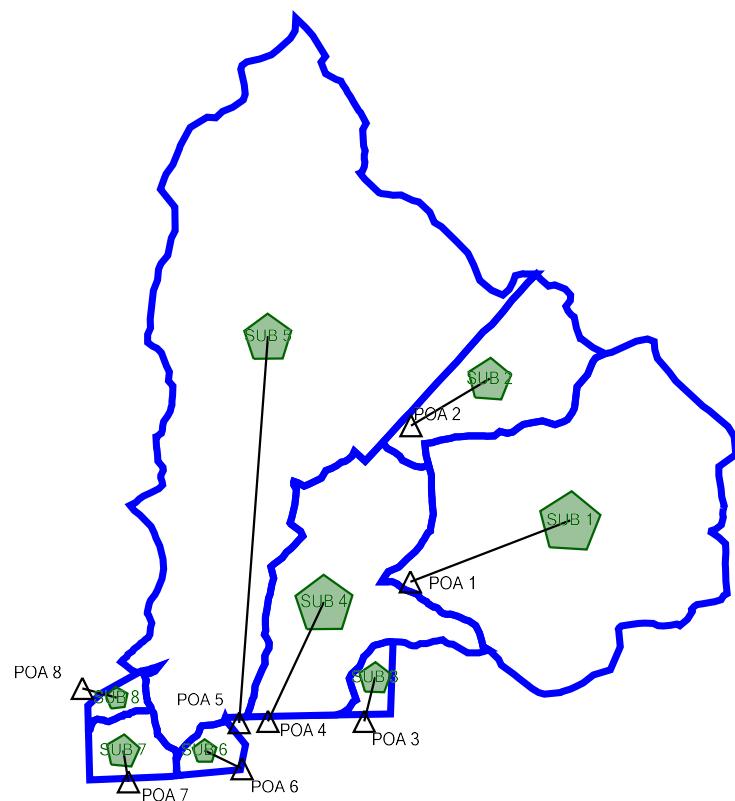
##### *Segment 1: Overland Flow*

Length =	100	ft
Top Elev =	398.00	ft
Bot Elev =	393.00	ft
Height =	5	ft
Slope =	0.0500	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>9.51</b>	<b>minutes</b>

##### *Segment 2: Concentrated Flow*

Length =	697	ft
Top Elev =	393.00	ft
Bot Elev =	365.00	ft
Height =	28	ft
Slope =	0.0402	ft/ft
Paved ? =	No	
Velocity =	3.23	ft/sec
<b>Segment Time =</b>	<b>3.59</b>	<b>minutes</b>

<b>Time of Concentration =</b>	13.10	minutes
<b>SCS Lag Time =</b>	7.86	minutes (SCS Lag = 0.6* Tc)
<b>Time Increment =</b>	2.28	minutes (= 0.29*SCS Lag)

**Scenario: Pre-  
Development**

**FlexTable: Catchment  
Table (AWH20000.ppc)**
**Current Time: 0.00 min**

Notes	Label	Area (User Defined) (acres)	SCS CN	Time of Concentration (min)
PRE	SUB 1	236.88	89.0	40.80
PRE	SUB 2	59.90	87.0	31.12
PRE	SUB 3	8.11	76.0	15.64
PRE	SUB 4	108.57	78.0	33.28
PRE	SUB 5	424.89	84.0	48.15
PRE	SUB 6	8.56	75.0	14.89
PRE	SUB 7	15.67	61.0	20.38
PRE	SUB 8	6.23	53.0	13.10

### Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)
SUB 1	Pre-Dev 1 yr	1	34.657	745.00	283.5
SUB 1	Pre-Dev 10 yr	10	74.868	745.00	545.3
SUB 2	Pre-Dev 1 yr	1	8.007	739.00	77.3
SUB 2	Pre-Dev 10 yr	10	17.950	738.00	153.0
SUB 5	Pre-Dev 1 yr	1	48.954	751.00	359.7
SUB 5	Pre-Dev 10 yr	10	116.278	751.00	787.2
SUB 4	Pre-Dev 1 yr	1	9.218	741.00	80.9
SUB 4	Pre-Dev 10 yr	10	24.755	741.00	204.9
SUB 7	Pre-Dev 1 yr	1	0.405	737.00	2.4
SUB 7	Pre-Dev 10 yr	10	1.820	733.00	17.2
SUB 8	Pre-Dev 1 yr	1	0.061	754.00	0.2
SUB 8	Pre-Dev 10 yr	10	0.458	729.00	4.3
SUB 6	Pre-Dev 1 yr	1	0.618	729.00	8.3
SUB 6	Pre-Dev 10 yr	10	1.774	728.00	22.0
SUB 3	Pre-Dev 1 yr	1	0.620	730.00	8.2
SUB 3	Pre-Dev 10 yr	10	1.739	728.00	21.2

### Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)
POA 1	Pre-Dev 1 yr	1	34.657	745.00	283.5
POA 1	Pre-Dev 10 yr	10	74.868	745.00	545.3
POA 3	Pre-Dev 1 yr	1	0.620	730.00	8.2
POA 3	Pre-Dev 10 yr	10	1.739	728.00	21.2
POA 4	Pre-Dev 1 yr	1	9.218	741.00	80.9
POA 4	Pre-Dev 10 yr	10	24.755	741.00	204.9
POA 5	Pre-Dev 1 yr	1	48.954	751.00	359.7
POA 5	Pre-Dev 10 yr	10	116.278	751.00	787.2
POA 6	Pre-Dev 1 yr	1	0.618	729.00	8.3
POA 6	Pre-Dev 10 yr	10	1.774	728.00	22.0
POA 7	Pre-Dev 1 yr	1	0.405	737.00	2.4
POA 7	Pre-Dev 10 yr	10	1.820	733.00	17.2
POA 8	Pre-Dev 1 yr	1	0.061	754.00	0.2
POA 8	Pre-Dev 10 yr	10	0.458	729.00	4.3
POA 2	Pre-Dev 1 yr	1	8.007	739.00	77.3
POA 2	Pre-Dev 10 yr	10	17.950	738.00	153.0



**MCADAMS**

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**THE POINT  
PHASES 1-10 AND 14  
PRELIMINARY PLAT PLANS  
EAST YOUNG STREET  
TOWN OF ROLESVILLE, WAKE FOREST TOWNSHIP,  
WAKE COUNTY, NORTH CAROLINA**

**REVISIONS**

NO.	DATE
1	04.09.2020 REV PER TOWN COMMENTS

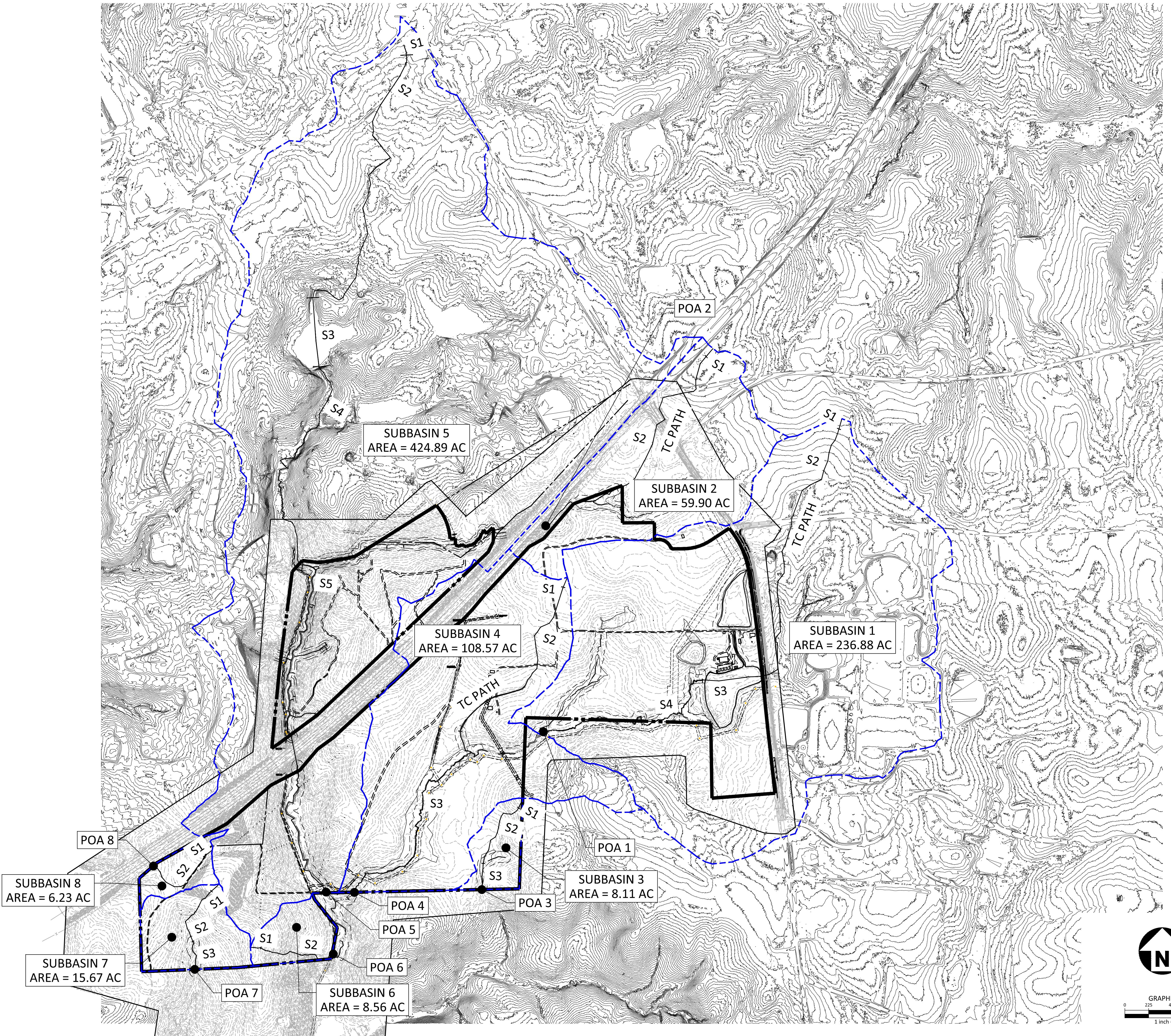
**PLAN INFORMATION**

PROJECT NO.	AWH-20000
FILENAME	AWH-20000.PRE
CHECKED BY	DCW
DRAWN BY	LK
SCALE	1" = 450'
DATE	06.19.2020

**SHEET**

PRE DEVELOPMENT  
HYDROLOGY MAP

**PRE**



*POST-DEVELOPMENT  
HYDROLOGIC CALCULATIONS*

The Point  
AWH-20000

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Total Area (ac)
Low Density Residential	B	68		20	0.06	0.29
Low Density Residential	D	84		20	4.53	22.63
Medium Density Residential	B	70		25	0.29	1.14
Medium Density Residential	D	85		25	0.02	0.08
Mixed Use Neighborhood	B	85		65	8.84	13.59
Mixed Use Neighborhood	B/D	92		65	2.68	4.12
Mixed Use Neighborhood	C	90		65	1.16	1.79
Mixed Use Neighborhood	D	92		65	9.40	14.46
Open	B	39	Yes	0	0.00	10.36
Open	B/D	80	Yes	0	0.00	0.23
Open	D	80	Yes	0	0.00	2.87
Pond		100		0	0.00	0.00
Pond	B	100	Yes	0	0.00	0.12
Pond	B/D	100	Yes	0	0.00	0.02
Pond	D	100	Yes	0	0.00	6.78
Roads		98		100	0.00	0.00
Roads	B	98	Yes	100	0.17	0.17
Roads	D	98	Yes	100	0.00	0.00
Roadway		98		100	7.20	7.20
School	B	88		72	12.90	17.91
School	B/D	93		72	6.11	8.49
School	D	93		72	43.84	60.89
Sidewalk		98		100	0.00	0.00
Sidewalk	B	98	Yes	100	0.09	0.09
Sidewalk	D	98	Yes	100	0.00	0.00
SingleFam60	B	80	Yes	50	0.05	0.09
SingleFam60	B/D	89	Yes	50	0.01	0.01
SingleFam60	D	89	Yes	50	0.00	0.00
Townhome22	B	95	Yes	91	0.00	0.00
Townhome22	D	96	Yes	91	0.03	0.03
Wooded	B	55	Yes	0	0.00	4.58
Wooded	B/D	77	Yes	0	0.00	6.12
Wooded	C	70	Yes	0	0.00	0.03
Wooded	D	77	Yes	0	0.00	0.60
<b>Total Area</b>		<b>184.73 ac</b>				
<b>Total Impervious Area</b>		<b>97.36 ac</b>				
<b>Onsite Area</b>		<b>32.12 ac</b>				
<b>Onsite Impervious Area</b>		<b>0.34 ac</b>				
<b>Percent Impervious</b>		<b>53 %</b>				
<b>Composite Curve Number</b>		<b>86</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

**Segment 1: Overland Flow**

Length =	100	ft
Top Elev =	426.00	ft
Bot Elev =	425.00	ft
Height =	1	ft
Slope =	0.0100	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>13.74</b>	<b>minutes</b>

**Segment 2: Concentrated Flow**

Length =	2645	ft
Top Elev =	425.00	ft
Bot Elev =	374.00	ft
Height =	51	ft
Slope =	0.0193	ft/ft
Paved ? =	No	
Velocity =	2.24	ft/sec
<b>Segment Time =</b>	<b>19.68</b>	<b>minutes</b>

**Segment 3: Open Water Flow**

Length =	580	ft
Top Elev =	374.00	ft
Bot Elev =	372.00	ft
<b>Segment Time =</b>	<b>0.00</b>	<b>minutes</b>

**Segment 4: Channel Flow**

Length =	2088	ft
Top Elev =	372.00	ft
Bot Elev =	344.00	ft
Height =	28	ft
Slope =	0.0134	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	4.72	ft/sec
<b>Segment Time =</b>	<b>7.38</b>	<b>minutes</b>

<b>Time of Concentration =</b>	<b>40.80</b>	<b>minutes</b>
<b>SCS Lag Time =</b>	<b>24.48</b>	<b>minutes (SCS Lag = 0.6* Tc)</b>
<b>Time Increment =</b>	<b>7.10</b>	<b>minutes (= 0.29*SCS Lag)</b>

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Total Area (ac)
Mixed Use Neighborhood	B	61		65	0.27	0.42
Mixed Use Neighborhood	D	92		65	1.18	1.81
Open	B	39	Yes	0	0.00	2.70
Open	D	80	Yes	0	0.00	1.68
Pond	B	100	Yes	0	0.00	0.01
Roads		98		100	0.00	0.00
Roads	B	98	Yes	100	1.99	1.99
Roads	D	98	Yes	100	0.61	0.61
Roadway		98		100	0.00	0.00
Sidewalk	B	98	Yes	100	0.48	0.48
Sidewalk	D	98	Yes	100	0.16	0.16
SingleFam39	D	92	Yes	65	0.04	0.06
SingleFam40	B	84	Yes	62	1.15	1.85
SingleFam40	D	91	Yes	62	0.10	0.16
SingleFam60	B	80	Yes	50	0.36	0.72
Wooded	B	55	Yes	0	0.00	0.06
<b>Total Area</b>		<b>12.71 ac</b>				
<b>Total Impervious Area</b>		<b>6.33 ac</b>				
<b>Onsite Area</b>		<b>10.49 ac</b>				
<b>Onsite Impervious Area</b>		<b>4.88 ac</b>				
<b>Percent Impervious</b>		<b>50 %</b>				
<b>Composite Curve Number</b>		<b>78</b>				

#### Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Total Area (ac)
Mixed Use Neighborhood	B	85		65	0.16	0.24
Mixed Use Neighborhood	B/D	92		65	0.00	0.00
Mixed Use Neighborhood	D	92		65	0.03	0.04
Open	B	61	Yes	0	0.00	1.26
Open	B/D	80	Yes	0	0.00	0.01
Open	D	80	Yes	0	0.00	1.53
Roads	B	98	Yes	100	0.58	0.58
Roads	D	98	Yes	100	0.82	0.82
Roadway		98		100	0.77	0.77
Sidewalk	B	98	Yes	100	0.19	0.19
Sidewalk	D	98	Yes	100	0.24	0.24
Townhome22	B	95	Yes	91	2.47	2.72
Townhome22	D	96	Yes	91	1.94	2.14
<b>Total Area</b>		<b>10.54 ac</b>				
<b>Total Impervious Area</b>		<b>7.21 ac</b>				
<b>Onsite Area</b>		<b>9.49 ac</b>				
<b>Onsite Impervious Area</b>		<b>6.26 ac</b>				
<b>Percent Impervious</b>		<b>68 %</b>				
<b>Composite Curve Number</b>		<b>89</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Total Area (ac)
Open	B	61	Yes	0	0.00	1.04
Open	D	80	Yes	0	0.00	1.34
Roads	B	98	Yes	100	1.67	1.67
Roads	D	98	Yes	100	0.94	0.94
Sidewalk	B	98	Yes	100	0.63	0.63
Sidewalk	D	98	Yes	100	0.37	0.37
SingleFam39	B	85	Yes	65	1.65	2.54
SingleFam39	D	92	Yes	65	1.40	2.16
SingleFam40	B	84	Yes	62	2.07	3.34
SingleFam40	D	91	Yes	62	0.56	0.91
SingleFam60	B	80	Yes	50	0.61	1.23
SingleFam60	D	89	Yes	50	0.16	0.32
Wooded	B	55	Yes	0	0.00	0.62
Wooded	D	77	Yes	0	0.00	0.35
<b>Total Area</b>		<b>17.45 ac</b>				
<b>Total Impervious Area</b>		<b>10.07 ac</b>				
<b>Onsite Area</b>		<b>17.45 ac</b>				
<b>Onsite Impervious Area</b>		<b>10.07 ac</b>				
<b>Percent Impervious</b>		<b>58 %</b>				
<b>Composite Curve Number</b>		<b>85</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

<b>Time of Concentration =</b>	5.00	minutes
<b>SCS Lag Time =</b>	3.00	minutes (SCS Lag = 0.6* Tc)
<b>Time Increment =</b>	0.87	minutes (= 0.29*SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Total Area (ac)
Open	B	61	Yes	0	0.00	1.41
Open	B/D	80	Yes	0	0.00	0.02
Open	D	80	Yes	0	0.00	0.01
Roads	B	98	Yes	100	1.64	1.64
Roads	B/D	98	Yes	100	0.06	0.06
Roads	D	98	Yes	100	0.01	0.01
Sidewalk	B	98	Yes	100	0.57	0.57
Sidewalk	B/D	98	Yes	100	0.02	0.02
Sidewalk	D	98	Yes	100	0.01	0.01
SingleFam60	B	80	Yes	50	4.29	8.59
SingleFam60	B/D	89	Yes	50	0.19	0.38
SingleFam60	D	89	Yes	50	0.00	0.00
Wooded	B	55	Yes	0	0.00	0.62
Wooded	B/D	77	Yes	0	0.00	0.07
<b>Total Area</b>		<b>13.40 ac</b>				
<b>Total Impervious Area</b>		<b>6.79 ac</b>				
<b>Onsite Area</b>		<b>13.40 ac</b>				
<b>Onsite Impervious Area</b>		<b>6.79 ac</b>				
<b>Percent Impervious</b>		<b>51 %</b>				
<b>Composite Curve Number</b>		<b>80</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

<b>Time of Concentration =</b>	5.00	minutes
<b>SCS Lag Time =</b>	3.00	minutes (SCS Lag = 0.6* Tc)
<b>Time Increment =</b>	0.87	minutes (= 0.29*SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Total Area (ac)
Open	B	61	Yes	0	0.00	0.76
Open	D	80	Yes	0	0.00	1.31
Roads	B	98	Yes	100	0.77	0.77
Roads	D	98	Yes	100	1.23	1.23
Sidewalk	B	98	Yes	100	0.23	0.23
Sidewalk	D	98	Yes	100	0.31	0.31
SingleFam39	B	85	Yes	65	0.90	1.39
SingleFam39	D	92	Yes	65	0.78	1.20
SingleFam40	B	84	Yes	62	0.33	0.53
SingleFam40	D	91	Yes	62	1.24	2.01
SingleFam60	B	80	Yes	50	0.66	1.31
SingleFam60	B/D	89	Yes	50	0.02	0.04
SingleFam60	D	89	Yes	50	0.49	0.98
Wooded	B	55	Yes	0	0.00	0.16
Wooded	D	77	Yes	0	0.00	0.02
<b>Total Area</b>		<b>12.25 ac</b>				
<b>Total Impervious Area</b>		<b>6.96 ac</b>				
<b>Onsite Area</b>		<b>12.25 ac</b>				
<b>Onsite Impervious Area</b>		<b>6.96 ac</b>				
<b>Percent Impervious</b>		<b>57 %</b>				
<b>Composite Curve Number</b>		<b>87</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

<b>Time of Concentration =</b>	5.00	minutes
<b>SCS Lag Time =</b>	3.00	minutes (SCS Lag = 0.6* Tc)
<b>Time Increment =</b>	0.87	minutes (= 0.29*SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Low Density Residential	D	84		20	3.59	17.96
Mixed Use Neighborhood	B	85		65	3.44	5.30
Mixed Use Neighborhood	B/D	92		65	0.58	0.89
Mixed Use Neighborhood	D	92		65	8.11	12.48
Open	B	61	Yes	0	0.00	0.67
Open	D	80	Yes	0	0.00	0.24
Roadway		98		100	13.35	13.35
Sidewalk	B	98	Yes	100	0.00	0.00
Wooded	B	55	Yes	0	0.00	0.42
Wooded	B/D	77	Yes	0	0.00	1.21
Wooded	D	77	Yes	0	0.00	0.53
<b>Total Area</b>		<b>53.05 ac</b>				
<b>Total Impervious Area</b>		<b>29.08 ac</b>				
<b>Onsite Area</b>		<b>3.07 ac</b>				
<b>Onsite Impervious Area</b>		<b>0.00 ac</b>				
<b>Percent Impervious</b>		<b>55 %</b>				
<b>Composite Curve Number</b>		<b>89</b>				

#### Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

##### Segment 1: Overland Flow

Length = 100 ft  
 Top Elev = 427.00 ft  
 Bot Elev = 426.00 ft  
 Height = 1 ft  
 Slope = 0.0100 ft/ft  
 Manning's n = 0.17 cultivated soils, residue cover  
 P (2-year/24-hour) = 3.46 inches (Rolesville, NC)  
**Segment Time = 13.74 minutes**

##### Segment 2: Concentrated Flow

Length = 2541 ft  
 Top Elev = 426.00 ft  
 Bot Elev = 368.00 ft  
 Height = 58 ft  
 Slope = 0.0228 ft/ft  
 Paved ? = No  
 Velocity = 2.44 ft/sec  
**Segment Time = 17.37 minutes**

Time of Concentration =	31.12	minutes
SCS Lag Time =	18.67	minutes (SCS Lag = 0.6* Tc)
Time Increment =	5.41	minutes (= 0.29*SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Open	C	74	Yes	0	0.00	0.06
Open	D	80	Yes	0	0.00	0.55
SingleFam50	C	88	Yes	59	0.07	0.12
SingleFam50	D	91	Yes	59	0.01	0.02
Wooded	C	70	Yes	0	0.00	0.37
Wooded	D	77	Yes	0	0.00	4.42
<b>Total Area</b>		<b>5.53 ac</b>				
<b>Total Impervious Area</b>		<b>0.08 ac</b>				
<b>Onsite Area</b>		<b>5.53 ac</b>				
<b>Onsite Impervious Area</b>		<b>0.08 ac</b>				
<b>Percent Impervious</b>		<b>1 %</b>				
<b>Composite Curve Number</b>		<b>77</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

**Segment 1: Overland Flow**

Length =	100	ft
Top Elev =	363.00	ft
Bot Elev =	357.00	ft
Height =	6	ft
Slope =	0.0600	ft/ft
Manning's n =	0.40	wooded
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>13.31</b>	<b>minutes</b>

**Segment 2: Concentrated Flow**

Length =	160	ft
Top Elev =	357.00	ft
Bot Elev =	341.00	ft
Height =	16	ft
Slope =	0.1000	ft/ft
Paved ? =	No	
Velocity =	5.10	ft/sec
<b>Segment Time =</b>	<b>0.52</b>	<b>minutes</b>

**Segment 3: Channel Flow**

Length =	477	ft
Top Elev =	341.00	ft
Bot Elev =	333.00	ft
Height =	8	ft
Slope =	0.0168	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	5.27	ft/sec
<b>Segment Time =</b>	<b>1.51</b>	<b>minutes</b>

Time of Concentration =	15.34	minutes
SCS Lag Time =	9.20	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	2.67	minutes (= 0.29 * SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Mixed Use Neighborhood	B	85		65	1.16	1.78
Mixed Use Neighborhood	B/D	92		65	0.55	0.84
Mixed Use Neighborhood	C	90		65	0.68	1.04
Mixed Use Neighborhood	D	92		65	4.66	7.16
Open	B/D	80	Yes	0	0.00	1.30
Open	C	74	Yes	0	0.00	0.37
Open	D	80	Yes	0	0.00	0.15
Roads	D	98	Yes	100	0.07	0.07
Sidewalk	B/D	98	Yes	100	0.01	0.01
Sidewalk	D	98	Yes	100	0.00	0.00
SingleFam50	C	88	Yes	59	0.01	0.01
SingleFam50	D	91	Yes	59	0.01	0.01
SingleFam60	D	89	Yes	50	0.02	0.03
Wooded	B/D	77	Yes	0	0.00	8.12
Wooded	C	70	Yes	0	0.00	2.67
Wooded	D	77	Yes	0	0.00	4.06
<b>Total Area</b>		<b>27.63 ac</b>				
<b>Total Impervious Area</b>		<b>7.15 ac</b>				
<b>Onsite Area</b>		<b>16.80 ac</b>				
<b>Onsite Impervious Area</b>		<b>0.11 ac</b>				
<b>Percent Impervious</b>		<b>26 %</b>				
<b>Composite Curve Number</b>		<b>82</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

**Segment 1: Overland Flow**

Length =	100	ft
Top Elev =	394.00	ft
Bot Elev =	392.00	ft
Height =	2	ft
Slope =	0.0200	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>13.72</b>	<b>minutes</b>

**Segment 2: Concentrated Flow**

Length =	1224	ft
Top Elev =	392.00	ft
Bot Elev =	341.00	ft
Height =	51	ft
Slope =	0.0417	ft/ft
Paved ? =	No	
Velocity =	3.29	ft/sec
<b>Segment Time =</b>	<b>6.19</b>	<b>minutes</b>

**Segment 3: Channel Flow**

Length =	2660	ft
Top Elev =	341.00	ft
Bot Elev =	302.00	ft
Height =	39	ft
Slope =	0.0147	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	15.00	sf (assume 5'w x 3'h channel)
Wetted Perimeter =	11.00	lf (assume 5'w x 3'h channel)
Channel Velocity =	4.93	ft/sec
<b>Segment Time =</b>	<b>8.99</b>	<b>minutes</b>

Time of Concentration =	28.91	minutes
SCS Lag Time =	17.35	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	5.03	minutes (= 0.29 * SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Open	B	61	Yes	0	0.00	0.85
Open	B/D	80	Yes	0	0.00	0.91
Open	D	80	Yes	0	0.00	0.78
Roads	B	98	Yes	100	1.78	1.78
Roads	B/D	98	Yes	100	0.88	0.88
Roads	D	98	Yes	100	1.13	1.13
Sidewalk	B	98	Yes	100	0.44	0.44
Sidewalk	B/D	98	Yes	100	0.25	0.25
Sidewalk	D	98	Yes	100	0.34	0.34
SingleFam39	B	85	Yes	65	1.39	2.14
SingleFam39	B/D	92	Yes	65	0.39	0.61
SingleFam39	D	92	Yes	65	0.21	0.32
SingleFam40	B	84	Yes	62	2.37	3.83
SingleFam40	B/D	91	Yes	62	0.58	0.94
SingleFam40	D	91	Yes	62	1.27	2.04
SingleFam60	B	80	Yes	50	0.35	0.71
SingleFam60	B/D	89	Yes	50	0.27	0.55
SingleFam60	D	89	Yes	50	0.43	0.86
Townhome22	B	95	Yes	91	0.53	0.59
Townhome22	B/D	96	Yes	91	1.43	1.57
Townhome22	D	96	Yes	91	0.91	1.00
Wooded	B/D	77	Yes	0	0.00	0.04
Wooded	D	77	Yes	0	0.00	0.50
<b>Total Area</b>		<b>23.05 ac</b>				
<b>Total Impervious Area</b>		<b>14.96 ac</b>				
<b>Onsite Area</b>		<b>23.05 ac</b>				
<b>Onsite Impervious Area</b>		<b>14.96 ac</b>				
<b>Percent Impervious</b>		<b>65 %</b>				
<b>Composite Curve Number</b>		<b>89</b>				

#### Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Open	B	61	Yes	0	0.00	0.41
Open	B/D	80	Yes	0	0.00	0.39
Open	D	80	Yes	0	0.00	1.41
Roads	B	98	Yes	100	0.71	0.71
Roads	B/D	98	Yes	100	0.40	0.40
Roads	D	98	Yes	100	1.24	1.24
Sidewalk	B	98	Yes	100	0.22	0.22
Sidewalk	B/D	98	Yes	100	0.10	0.10
Sidewalk	D	98	Yes	100	0.37	0.37
SingleFam50	B	83	Yes	59	0.44	0.74
SingleFam50	B/D	91	Yes	59	0.14	0.24
SingleFam50	D	91	Yes	59	1.45	2.45
Townhome22	B	95	Yes	91	1.30	1.43
Townhome22	B/D	96	Yes	91	0.16	0.17
Townhome22	D	96	Yes	91	2.59	2.84
Wooded	B/D	77	Yes	0	0.00	0.00
Wooded	D	77	Yes	0	0.00	0.35
<b>Total Area</b>		<b>13.48 ac</b>				
<b>Total Impervious Area</b>		<b>9.11 ac</b>				
<b>Onsite Area</b>		<b>13.48 ac</b>				
<b>Onsite Impervious Area</b>		<b>9.11 ac</b>				
<b>Percent Impervious</b>		<b>68 %</b>				
<b>Composite Curve Number</b>		<b>91</b>				

#### Time of Concentration Information

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Open	B/D	61	Yes	0	0.00	0.10
Open	C	74	Yes	0	0.00	0.68
Open	D	80	Yes	0	0.00	0.21
Roads	B/D	98	Yes	100	0.29	0.29
Roads	C	98	Yes	100	1.31	1.31
Roads	D	98	Yes	100	0.57	0.57
Sidewalk	B/D	98	Yes	100	0.08	0.08
Sidewalk	C	98	Yes	100	0.41	0.41
Sidewalk	D	98	Yes	100	0.16	0.16
SingleFam50	B/D	91	Yes	59	0.24	0.41
SingleFam50	C	88	Yes	59	4.67	7.92
SingleFam50	D	91	Yes	59	1.43	2.43
Wooded	B/D	77	Yes	0	0.00	0.23
Wooded	C	70	Yes	0	0.00	0.23
Wooded	D	77	Yes	0	0.00	1.11
<b>Total Area</b>		<b>16.12 ac</b>				
<b>Total Impervious Area</b>		<b>9.16 ac</b>				
<b>Onsite Area</b>		<b>16.12 ac</b>				
<b>Onsite Impervious Area</b>		<b>9.16 ac</b>				
<b>Percent Impervious</b>		<b>57 %</b>				
<b>Composite Curve Number</b>		<b>88</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

<b>Time of Concentration =</b>	5.00	minutes
<b>SCS Lag Time =</b>	3.00	minutes (SCS Lag = 0.6* Tc)
<b>Time Increment =</b>	0.87	minutes (= 0.29*SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Open	A	39	Yes	0	0.00	0.12
Open	B	61	Yes	0	0.00	0.03
Open	D	80	Yes	0	0.00	0.34
Roads	A	98	Yes	100	0.26	0.26
Roads	B	98	Yes	100	0.05	0.05
Roads	D	98	Yes	100	0.72	0.72
Sidewalk	A	98	Yes	100	0.09	0.09
Sidewalk	B	98	Yes	100	0.02	0.02
Sidewalk	D	98	Yes	100	0.26	0.26
SingleFam50	A	74	Yes	59	0.84	1.42
SingleFam50	B	83	Yes	59	0.33	0.56
SingleFam50	D	91	Yes	59	2.46	4.16
Wooded	B/D	77	Yes	0	0.00	0.05
Wooded	D	77	Yes	0	0.00	1.16
<b>Total Area</b>		<b>9.24 ac</b>				
<b>Total Impervious Area</b>		<b>5.03 ac</b>				
<b>Onsite Area</b>		<b>9.24 ac</b>				
<b>Onsite Impervious Area</b>		<b>5.03 ac</b>				
<b>Percent Impervious</b>		<b>54 %</b>				
<b>Composite Curve Number</b>		<b>86</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6* Tc)
Time Increment =	0.87	minutes (= 0.29*SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Total Area (ac)
Business Park	A	89		85	0.01	0.01
Business Park	B	92		85	0.02	0.02
Business Park	D	95		85	0.03	0.03
Commercial	D	95		85	0.86	1.01
High Density Residential	B	85		65	46.03	70.82
High Density Residential	D	92		65	33.44	51.45
Low Density Residential	B	65		20	0.18	0.92
Low Density Residential	D	82		20	0.37	1.85
Medium Density Residential	A	54		25	0.00	0.01
Medium Density Residential	B	70		25	11.98	47.92
Medium Density Residential	D	85		25	10.74	42.98
Mixed Use Neighborhood	B	85		65	4.39	6.75
Mixed Use Neighborhood	B/D	92		65	2.17	3.33
Mixed Use Neighborhood	D	92		65	7.93	12.20
Open	A	49	Yes	0	0.00	0.43
Open	B	69	Yes	0	0.00	11.30
Open	B/D	84	Yes	0	0.00	0.84
Open	D	84	Yes	0	0.00	12.80
Preserved Open Space	A	39		0	0.00	0.39
Preserved Open Space	B	61		0	0.00	4.48
Preserved Open Space	D	80		0	0.00	34.05
Roads	D	98	Yes	100	0.03	0.03
Roadway		98		100	56.52	56.52
School	B	88		72	0.34	0.47
School	D	93		72	5.12	7.11
Sidewalk	A	98	Yes	100	0.02	0.02
Sidewalk	B	98	Yes	100	0.32	0.32
Sidewalk	B/D	98	Yes	100	0.09	0.09
Sidewalk	D	98	Yes	100	0.98	0.98
SingleFam39	B	85	Yes	65	0.00	0.00
SingleFam39	B/D	92	Yes	65	0.00	0.00
SingleFam50	D	91	Yes	59	0.00	0.00
Town Center	B	92		85	5.55	6.53
Town Center	D	95		85	1.48	1.74
Townhome22	D	96	Yes	91	0.17	0.18
Trail	B	82	Yes	100	0.43	0.43
Trail	D	89	Yes	100	1.40	1.40
Wooded	B	55	Yes	0	0.00	3.88
Wooded	B/D	77	Yes	0	0.00	0.15
Wooded	D	77	Yes	0	0.00	33.22
<b>Total Area</b>		<b>416.66 ac</b>				
<b>Total Impervious Area</b>		<b>190.59 ac</b>				
<b>Onsite Area</b>		<b>66.07 ac</b>				
<b>Onsite Impervious Area</b>		<b>3.44 ac</b>				
<b>Percent Impervious</b>		<b>46 %</b>				
<b>Composite Curve Number</b>		<b>84</b>				

**Time of Concentration Information**

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

**Segment 1: Overland Flow**

Length =	100	ft
Top Elev =	440.00	ft
Bot Elev =	438.00	ft
Height =	2	ft
Slope =	0.0200	ft/ft
Manning's n =	0.24	dense grasses
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
<b>Segment Time =</b>	<b>13.72</b>	<b>minutes</b>

**Segment 2: Concentrated Flow**

Length =	2989	ft
Top Elev =	438.00	ft
Bot Elev =	372.00	ft
Height =	66	ft
Slope =	0.0221	ft/ft
Paved ? =	No	
Velocity =	2.40	ft/sec
<b>Segment Time =</b>	<b>20.78</b>	<b>minutes</b>

**Segment 3: Open Water Flow**

Length =	655	ft
Top Elev =	372.00	ft
Bot Elev =	372.00	ft
<b>Segment Time =</b>	<b>0.00</b>	<b>minutes</b>

**Segment 4: Concentrated Flow**

Length =	2379	ft
Top Elev =	372.00	ft
Bot Elev =	320.00	ft
Height =	52	ft
Slope =	0.0219	ft/ft
Paved ? =	No	
Velocity =	2.39	ft/sec
<b>Segment Time =</b>	<b>16.62</b>	<b>minutes</b>

**Segment 5: Channel Flow**

Length =	3730	ft
Top Elev =	320.00	ft
Bot Elev =	292.00	ft
Height =	28	ft
Slope =	0.0075	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	32.00	sf (assume 8'w x 4'h channel)
Wetted Perimeter =	16.00	lf (assume 8'w x 4'h channel)
Channel Velocity =	4.55	ft/sec
<b>Segment Time =</b>	<b>13.65</b>	<b>minutes</b>

<b>Time of Concentration =</b>	<b>48.15</b>	<b>minutes</b>
<b>SCS Lag Time =</b>	<b>28.89</b>	<b>minutes (SCS Lag = 0.6* Tc)</b>
<b>Time Increment =</b>	<b>8.38</b>	<b>minutes (= 0.29*SCS Lag)</b>

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Open	A	39	Yes	0	0.00	0.09
Open	B	61	Yes	0	0.00	0.36
Open	D	80	Yes	0	0.00	0.59
Roads	A	98	Yes	100	0.20	0.20
Roads	B	98	Yes	100	0.45	0.45
Roads	D	98	Yes	100	1.28	1.28
Sidewalk	A	98	Yes	100	0.07	0.07
Sidewalk	B	98	Yes	100	0.11	0.11
Sidewalk	D	98	Yes	100	0.38	0.38
SingleFam50	A	74	Yes	59	0.63	1.06
SingleFam50	B	83	Yes	59	0.33	0.55
SingleFam50	D	91	Yes	59	2.22	3.76
Townhome22	B	95	Yes	91	0.52	0.58
Townhome22	D	96	Yes	91	0.54	0.59
Wooded	B	55	Yes	0	0.00	0.03
Wooded	D	77	Yes	0	0.00	1.58
<b>Total Area</b>		<b>11.68 ac</b>				
<b>Total Impervious Area</b>		<b>6.72 ac</b>				
<b>Onsite Area</b>		<b>11.68 ac</b>				
<b>Onsite Impervious Area</b>		<b>6.72 ac</b>				
<b>Percent Impervious</b>		<b>58 %</b>				
<b>Composite Curve Number</b>		<b>87</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

<b>Time of Concentration =</b>	5.00	minutes
<b>SCS Lag Time =</b>	3.00	minutes (SCS Lag = 0.6 * Tc)
<b>Time Increment =</b>	0.87	minutes (= 0.29 * SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Open	D	80	Yes	0	0.00	1.90
Roads	D	98	Yes	100	0.59	0.59
Sidewalk	D	98	Yes	100	0.17	0.17
Townhome22	D	96	Yes	91	1.49	1.64
Wooded	D	77	Yes	0	0.00	0.95
<b>Total Area</b>		<b>5.25 ac</b>				
<b>Total Impervious Area</b>		<b>2.26 ac</b>				
<b>Onsite Area</b>		<b>5.25 ac</b>				
<b>Onsite Impervious Area</b>		<b>2.26 ac</b>				
<b>Percent Impervious</b>		<b>43 %</b>				
<b>Composite Curve Number</b>		<b>87</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

<b>Time of Concentration =</b>	5.00	minutes
<b>SCS Lag Time =</b>	3.00	minutes (SCS Lag = 0.6* Tc)
<b>Time Increment =</b>	0.87	minutes (= 0.29*SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Total Area (ac)
Open	A	39	Yes	0	0.00	0.12
Open	B	61	Yes	0	0.00	0.02
Open	D	80	Yes	0	0.00	2.39
Roads	A	98	Yes	100	0.06	0.06
Roads	B	98	Yes	100	0.04	0.04
Roads	D	98	Yes	100	1.77	1.77
Sidewalk	A	98	Yes	100	0.02	0.02
Sidewalk	B	98	Yes	100	0.02	0.02
Sidewalk	D	98	Yes	100	0.63	0.63
SingleFam50	A	74	Yes	59	0.67	1.13
SingleFam50	B	83	Yes	59	0.25	0.43
SingleFam50	D	91	Yes	59	0.32	0.54
Townhome22	A	93	Yes	91	0.00	0.00
Townhome22	D	96	Yes	91	4.84	5.32
Wooded	A	30	Yes	0	0.00	0.07
Wooded	B	55	Yes	0	0.00	0.03
Wooded	D	77	Yes	0	0.00	2.64
<b>Total Area</b>		<b>15.25 ac</b>				
<b>Total Impervious Area</b>		<b>8.63 ac</b>				
<b>Onsite Area</b>		<b>15.25 ac</b>				
<b>Onsite Impervious Area</b>		<b>8.63 ac</b>				
<b>Percent Impervious</b>		<b>57 %</b>				
<b>Composite Curve Number</b>		<b>87</b>				

**Time of Concentration Information**

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
SingleFam50	B	83	Yes	59	0.00	0.00
SingleFam50	D	91	Yes	59	0.00	0.00
Wooded	B	55	Yes	0	0.00	0.12
Wooded	D	77	Yes	0	0.00	1.08
<b>Total Area</b>		<b>1.19 ac</b>				
<b>Total Impervious Area</b>		<b>0.00 ac</b>				
<b>Onsite Area</b>		<b>1.19 ac</b>				
<b>Onsite Impervious Area</b>		<b>0.00 ac</b>				
<b>Percent Impervious</b>		<b>0 %</b>				
<b>Composite Curve Number</b>		<b>75</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

Time of Concentration =	5.00	minutes
SCS Lag Time =	3.00	minutes (SCS Lag = 0.6 * Tc)
Time Increment =	0.87	minutes (= 0.29 * SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Total Area (ac)
Open	A	39	Yes	0	0.00	1.13
Open	B	61	Yes	0	0.00	2.18
Open	D	80	Yes	0	0.00	0.19
Roads	B	98	Yes	100	1.20	1.20
Roads	D	98	Yes	100	0.27	0.27
Sidewalk	B	98	Yes	100	0.34	0.34
Sidewalk	D	98	Yes	100	0.10	0.10
SingleFam50	A	74	Yes	59	0.36	0.61
SingleFam50	B	83	Yes	59	3.74	6.35
SingleFam50	D	91	Yes	59	1.45	2.45
Wooded	A	30	Yes	0	0.00	0.18
Wooded	B	55	Yes	0	0.00	1.17
Wooded	D	77	Yes	0	0.00	1.29
<b>Total Area</b>		<b>17.45 ac</b>				
<b>Total Impervious Area</b>		<b>7.45 ac</b>				
<b>Onsite Area</b>		<b>17.45 ac</b>				
<b>Onsite Impervious Area</b>		<b>7.45 ac</b>				
<b>Percent Impervious</b>		<b>43 %</b>				
<b>Composite Curve Number</b>		<b>77</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

<b>Time of Concentration =</b>	5.00	minutes
<b>SCS Lag Time =</b>	3.00	minutes (SCS Lag = 0.6 * Tc)
<b>Time Increment =</b>	0.87	minutes (= 0.29 * SCS Lag)

Land Use	HSG	CN	Onsite	Percent Impervious (%)	Impervious Area (ac)	Area (ac)
Open	A	39	Yes	0	0.00	0.19
Open	B	61	Yes	0	0.00	0.42
Open	D	80	Yes	0	0.00	0.00
Sidewalk	A	98	Yes	100	0.03	0.03
Sidewalk	B	98	Yes	100	0.13	0.13
Sidewalk	D	98	Yes	100	0.03	0.03
Wooded	A	30	Yes	0	0.00	0.08
Wooded	B	55	Yes	0	0.00	1.09
Wooded	D	77	Yes	0	0.00	0.17
<b>Total Area</b>		<b>2.13 ac</b>				
<b>Total Impervious Area</b>		<b>0.18 ac</b>				
<b>Onsite Area</b>		<b>2.13 ac</b>				
<b>Onsite Impervious Area</b>		<b>0.18 ac</b>				
<b>Percent Impervious</b>		<b>9 %</b>				
<b>Composite Curve Number</b>		<b>59</b>				

**Time of Concentration Information**

*Time of concentration is calculated using the SCS Segmental Approach (TR-55).*

**Segment 1: Overland Flow**

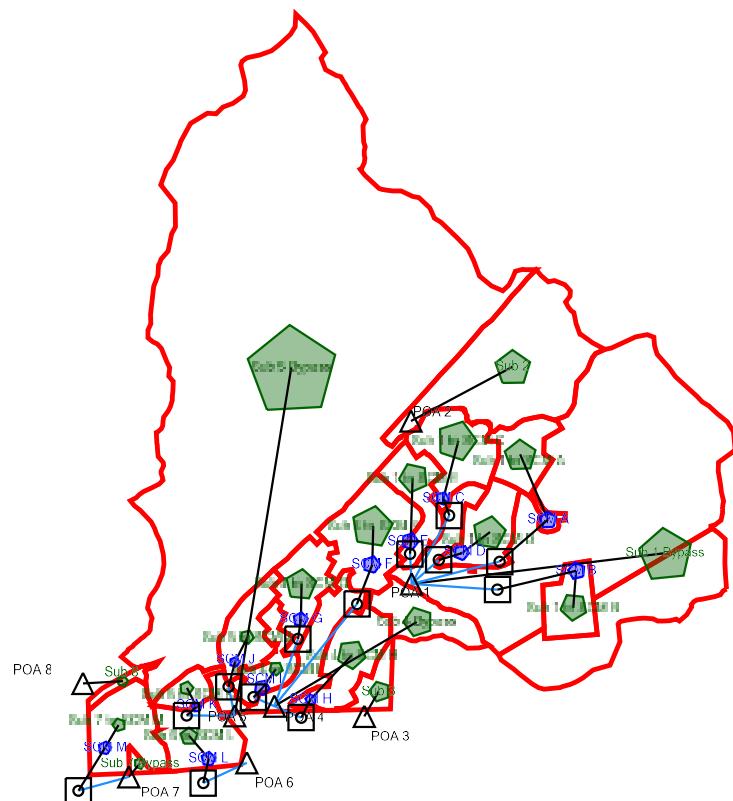
Length = 100 ft  
 Top Elev = 403.00 ft  
 Bot Elev = 393.00 ft  
 Height = 10 ft  
 Slope = 0.1000 ft/ft  
 Manning's n = 0.24 dense grasses  
 P (2-year/24-hour) = 3.46 inches (Rolesville, NC)  
**Segment Time = 7.21 minutes**

**Segment 2: Concentrated Flow**

Length = 531 ft  
 Top Elev = 393.00 ft  
 Bot Elev = 365.00 ft  
 Height = 28 ft  
 Slope = 0.0527 ft/ft  
 Paved ? = No  
 Velocity = 3.70 ft/sec  
**Segment Time = 2.39 minutes**

<b>Time of Concentration =</b>	9.60	minutes
<b>SCS Lag Time =</b>	5.76	minutes (SCS Lag = 0.6 * Tc)
<b>Time Increment =</b>	1.67	minutes (= 0.29 * SCS Lag)

## **Scenario: Post-Development**



**FlexTable: Catchment  
Table (AWH20000.ppc)**

Notes	Label	Area (User Defined) (acres)	SCS CN	Time of Concentration (min)
POST	Sub 1 Bypass	184.73	86	40.80
POST	Sub 1 to SCM A	12.71	78	5.00
POST	Sub 1 to SCM B	10.54	89	5.00
POST	Sub 1 to SCM C	17.45	85	5.00
POST	Sub 1 to SCM D	13.40	80	5.00
POST	Sub 1 to SCM E	12.25	87	5.00
POST	Sub 2	53.05	89	31.12
POST	Sub 4 Bypass	27.63	82	28.91
POST	Sub 4 to SCM F	23.05	89	5.00
POST	Sub 4 to SCM G	13.48	91	5.00
POST	Sub 4 to SCM H	16.12	88	5.00
POST	Sub 5 Bypass	416.66	84	48.15
POST	Sub 5 to SCM I	9.24	86	5.00
POST	Sub 5 to SCM J	11.68	87	5.00
POST	Sub 5 to SCM K	5.25	87	5.00
POST	Sub 6 to SCM L	15.25	87	5.00
POST	Sub 7 Bypass	1.19	75	5.00
POST	Sub 7 to SCM M	17.45	77	5.00
POST	Sub 8	2.13	59	5.00

### Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)
Sub 5 Bypass	Post-Dev 1 yr	1	48.006	751.00	352.7
Sub 5 Bypass	Post-Dev 10 yr	10	114.026	751.00	771.9
Sub 2	Post-Dev 1 yr	1	7.780	739.00	75.1
Sub 2	Post-Dev 10 yr	10	16.804	738.00	142.1
Sub 1 Bypass	Post-Dev 1 yr	1	23.493	745.00	191.4
Sub 1 Bypass	Post-Dev 10 yr	10	53.683	745.00	395.2
Sub 1 to SCM B	Post-Dev 1 yr	1	1.556	721.00	33.6
Sub 1 to SCM B	Post-Dev 10 yr	10	3.360	721.00	60.0
Sub 1 to SCM A	Post-Dev 1 yr	1	1.089	722.00	22.5
Sub 1 to SCM A	Post-Dev 10 yr	10	2.922	721.00	53.2
Sub 1 to SCM D	Post-Dev 1 yr	1	1.278	722.00	26.8
Sub 1 to SCM D	Post-Dev 10 yr	10	3.284	721.00	59.9
Sub 1 to SCM C	Post-Dev 1 yr	1	2.137	721.00	46.0
Sub 1 to SCM C	Post-Dev 10 yr	10	4.972	721.00	90.2
Sub 1 to SCM E	Post-Dev 1 yr	1	1.649	721.00	35.6
Sub 1 to SCM E	Post-Dev 10 yr	10	3.695	721.00	66.6
Sub 4 to SCM F	Post-Dev 1 yr	1	3.403	721.00	73.6
Sub 4 to SCM F	Post-Dev 10 yr	10	7.347	721.00	131.2
Sub 4 to SCM H	Post-Dev 1 yr	1	2.273	721.00	49.2
Sub 4 to SCM H	Post-Dev 10 yr	10	4.999	721.00	89.7
Sub 3	Post-Dev 1 yr	1	0.447	728.00	6.0
Sub 3	Post-Dev 10 yr	10	1.226	728.00	15.1
Sub 4 Bypass	Post-Dev 1 yr	1	2.898	737.00	28.6
Sub 4 Bypass	Post-Dev 10 yr	10	7.157	736.00	64.2
Sub 4 to SCM G	Post-Dev 1 yr	1	2.178	721.00	46.8
Sub 4 to SCM G	Post-Dev 10 yr	10	4.534	721.00	79.9
Sub 5 to SCM J	Post-Dev 1 yr	1	1.572	721.00	34.0
Sub 5 to SCM J	Post-Dev 10 yr	10	3.523	721.00	63.5
Sub 4 to SCM I	Post-Dev 1 yr	1	1.187	721.00	25.6
Sub 4 to SCM I	Post-Dev 10 yr	10	2.709	721.00	49.0
Sub 6 to SCM L	Post-Dev 1 yr	1	2.053	721.00	44.4
Sub 6 to SCM L	Post-Dev 10 yr	10	4.600	721.00	82.9
Sub 5 to SCM K	Post-Dev 1 yr	1	0.707	721.00	15.3
Sub 5 to SCM K	Post-Dev 10 yr	10	1.583	721.00	28.5
Sub 7 to SCM M	Post-Dev 1 yr	1	1.416	722.00	29.0
Sub 7 to SCM M	Post-Dev 10 yr	10	3.882	721.00	70.6
Sub 7 Bypass	Post-Dev 1 yr	1	0.086	722.00	1.7
Sub 7 Bypass	Post-Dev 10 yr	10	0.247	721.00	4.5
Sub 8	Post-Dev 1 yr	1	0.045	729.00	0.3
Sub 8	Post-Dev 10 yr	10	0.224	726.00	2.9

### Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)
POA 1	Post-Dev 1 yr	1	25.582	746.00	195.5
POA 1	Post-Dev 10 yr	10	63.346	745.00	446.9
POA 3	Post-Dev 1 yr	1	0.447	728.00	6.0
POA 3	Post-Dev 10 yr	10	1.226	728.00	15.1
POA 4	Post-Dev 1 yr	1	8.312	733.00	52.5

**Node Summary**

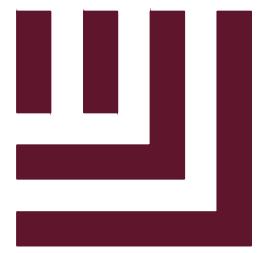
Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)
POA 4	Post-Dev 10 yr	10	22.783	729.00	194.5
POA 5	Post-Dev 1 yr	1	48.818	751.00	353.5
POA 5	Post-Dev 10 yr	10	117.021	751.00	787.1
POA 6	Post-Dev 1 yr	1	0.954	903.00	1.1
POA 6	Post-Dev 10 yr	10	2.831	751.00	19.1
POA 7	Post-Dev 1 yr	1	0.371	722.00	1.9
POA 7	Post-Dev 10 yr	10	1.322	721.00	4.8
POA 8	Post-Dev 1 yr	1	0.045	729.00	0.3
POA 8	Post-Dev 10 yr	10	0.224	726.00	2.9
POA 2	Post-Dev 1 yr	1	7.780	739.00	75.1
POA 2	Post-Dev 10 yr	10	16.804	738.00	142.1

**Pond Summary**

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM A (IN)	Post-Dev 1 yr	1	1.089	722.00	22.5	(N/A)	(N/A)
SCM A (OUT)	Post-Dev 1 yr	1	0.160	1,440.00	0.2	382.76	0.930
SCM A (IN)	Post-Dev 10 yr	10	2.922	721.00	53.2	(N/A)	(N/A)
SCM A (OUT)	Post-Dev 10 yr	10	1.683	752.00	13.2	383.92	1.397
SCM D (IN)	Post-Dev 1 yr	1	1.278	722.00	26.8	(N/A)	(N/A)
SCM D (OUT)	Post-Dev 1 yr	1	0.209	1,440.00	0.2	355.96	1.068
SCM D (IN)	Post-Dev 10 yr	10	3.284	721.00	59.9	(N/A)	(N/A)
SCM D (OUT)	Post-Dev 10 yr	10	0.882	905.00	1.5	358.08	2.434
SCM B (IN)	Post-Dev 1 yr	1	1.556	721.00	33.6	(N/A)	(N/A)
SCM B (OUT)	Post-Dev 1 yr	1	0.731	753.00	5.4	379.23	0.895
SCM B (IN)	Post-Dev 10 yr	10	3.360	721.00	60.0	(N/A)	(N/A)
SCM B (OUT)	Post-Dev 10 yr	10	2.526	727.00	34.1	380.10	1.198
SCM L (IN)	Post-Dev 1 yr	1	2.053	721.00	44.4	(N/A)	(N/A)
SCM L (OUT)	Post-Dev 1 yr	1	0.954	903.00	1.1	302.40	1.361
SCM L (IN)	Post-Dev 10 yr	10	4.600	721.00	82.9	(N/A)	(N/A)
SCM L (OUT)	Post-Dev 10 yr	10	2.831	751.00	19.1	303.93	2.336
SCM M (IN)	Post-Dev 1 yr	1	1.416	722.00	29.0	(N/A)	(N/A)
SCM M (OUT)	Post-Dev 1 yr	1	0.285	1,440.00	0.3	341.79	1.131
SCM M (IN)	Post-Dev 10 yr	10	3.882	721.00	70.6	(N/A)	(N/A)
SCM M (OUT)	Post-Dev 10 yr	10	1.075	912.00	1.7	344.06	2.833
SCM K (IN)	Post-Dev 1 yr	1	0.707	721.00	15.3	(N/A)	(N/A)
SCM K (OUT)	Post-Dev 1 yr	1	0.080	1,440.00	0.1	314.00	0.627
SCM K (IN)	Post-Dev 10 yr	10	1.583	721.00	28.5	(N/A)	(N/A)

**Pond Summary**

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SCM K (OUT)	Post-Dev 10 yr	10	0.954	729.00	12.3	314.40	0.702
SCM I (IN)	Post-Dev 1 yr	1	1.187	721.00	25.6	(N/A)	(N/A)
SCM I (OUT)	Post-Dev 1 yr	1	0.686	757.00	2.1	320.52	0.663
SCM I (IN)	Post-Dev 10 yr	10	2.709	721.00	49.0	(N/A)	(N/A)
SCM I (OUT)	Post-Dev 10 yr	10	2.174	729.00	21.1	322.00	1.119
SCM J (IN)	Post-Dev 1 yr	1	1.572	721.00	34.0	(N/A)	(N/A)
SCM J (OUT)	Post-Dev 1 yr	1	0.731	903.00	0.9	312.51	1.033
SCM J (IN)	Post-Dev 10 yr	10	3.523	721.00	63.5	(N/A)	(N/A)
SCM J (OUT)	Post-Dev 10 yr	10	2.041	754.00	9.4	314.55	2.088
SCM H (IN)	Post-Dev 1 yr	1	2.273	721.00	49.2	(N/A)	(N/A)
SCM H (OUT)	Post-Dev 1 yr	1	1.345	756.00	4.0	336.56	1.300
SCM H (IN)	Post-Dev 10 yr	10	4.999	721.00	89.7	(N/A)	(N/A)
SCM H (OUT)	Post-Dev 10 yr	10	3.994	751.00	20.9	338.36	2.407
SCM C (IN)	Post-Dev 1 yr	1	2.137	721.00	46.0	(N/A)	(N/A)
SCM C (OUT)	Post-Dev 1 yr	1	0.838	784.00	2.2	379.10	1.340
SCM C (IN)	Post-Dev 10 yr	10	4.972	721.00	90.2	(N/A)	(N/A)
SCM C (OUT)	Post-Dev 10 yr	10	3.658	727.00	55.7	379.95	1.771
SCM E (IN)	Post-Dev 1 yr	1	1.649	721.00	35.6	(N/A)	(N/A)
SCM E (OUT)	Post-Dev 1 yr	1	0.151	1,440.00	0.2	360.35	1.498
SCM E (IN)	Post-Dev 10 yr	10	3.695	721.00	66.6	(N/A)	(N/A)
SCM E (OUT)	Post-Dev 10 yr	10	0.913	904.00	1.8	362.10	2.831
SCM F (IN)	Post-Dev 1 yr	1	3.403	721.00	73.6	(N/A)	(N/A)
SCM F (OUT)	Post-Dev 1 yr	1	2.121	730.00	23.7	347.29	1.513
SCM F (IN)	Post-Dev 10 yr	10	7.347	721.00	131.2	(N/A)	(N/A)
SCM F (OUT)	Post-Dev 10 yr	10	6.031	725.00	96.6	348.12	1.958
SCM G (IN)	Post-Dev 1 yr	1	2.178	721.00	46.8	(N/A)	(N/A)
SCM G (OUT)	Post-Dev 1 yr	1	1.261	783.00	2.1	344.92	1.366
SCM G (IN)	Post-Dev 10 yr	10	4.534	721.00	79.9	(N/A)	(N/A)
SCM G (OUT)	Post-Dev 10 yr	10	3.426	733.00	20.0	346.43	2.223



**MCADAMS**

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**CLIENT**

ASHTON WOODS  
5711 SIX FORKS ROAD, SUITE 300  
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**THE POINT  
PHASES 1-10 AND 14  
PRELIMINARY PLAT PLANS  
EAST YOUNG STREET  
TOWN OF ROLESVILLE, WAKE FOREST TOWNSHIP,  
WAKE COUNTY, NORTH CAROLINA**

**REVISIONS**

NO.	DATE
1	04.09.2020 REV PER TOWN COMMENTS
2	06.19.2020 REV PER MUNICIPAL COMMENTS

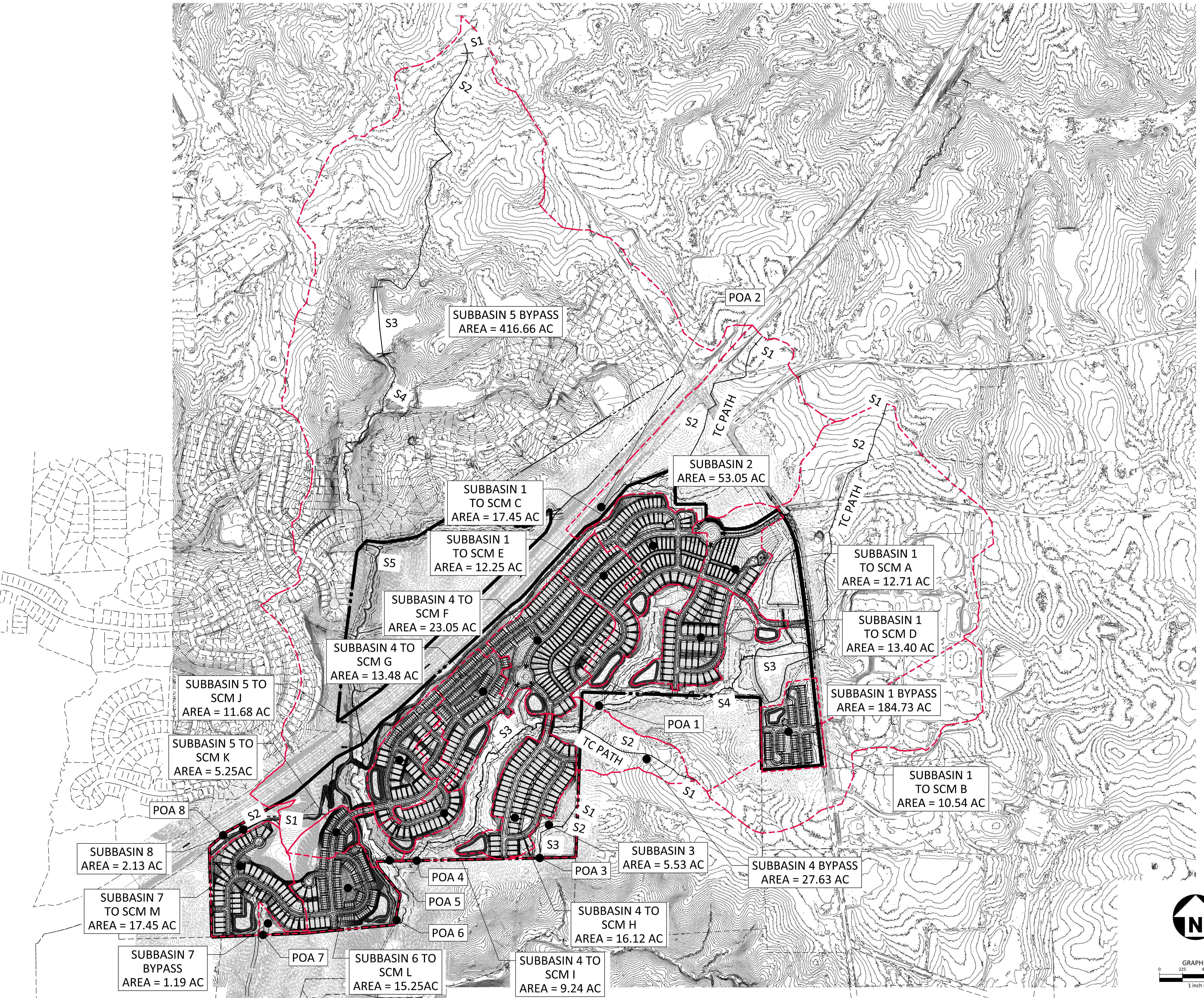
**PLAN INFORMATION**

PROJECT NO.	AWH-20000
FILENAME	AWH-20000 POST
CHECKED BY	DCW
DRAWN BY	LK
SCALE	1" = 450'
DATE	06.19.2020

**SHEET**

POST DEVELOPMENT  
HYDROLOGY MAP

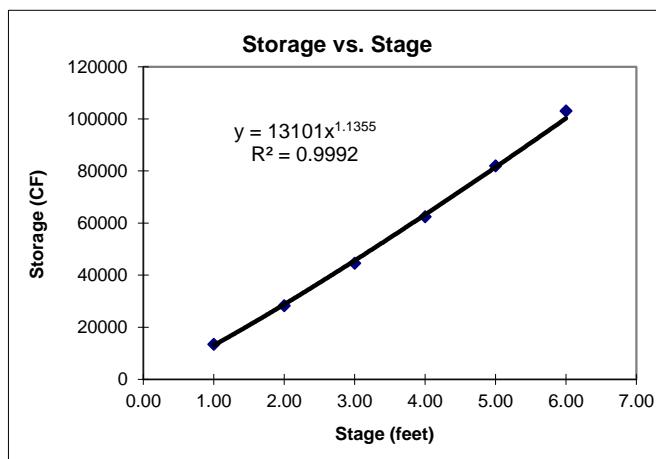
**POST**



*STORMWATER CONTROL MEASURE 'A'*  
*DESIGN CALCULATIONS*

**STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
380.00	0.00	12,708				
381.00	1.00	14,107	13408	13408	13408	1.02
382.00	2.00	15,562	14835	14835	28242	1.97
383.00	3.00	17,074	16318	16318	44560	2.94
384.00	4.00	18,642	17858	17858	62418	3.95
385.00	5.00	20,267	19455	19455	81873	5.02
386.00	6.00	21,949	21108	21108	102981	6.15



$K_s =$ $b =$	13101 1.1355
------------------	-----------------

**WET DETENTION BASIN SUMMARY**

**Enter the drainage area characteristics ==>**

Total drainage area to pond = 12.71 acres  
Total impervious area to pond = 6.33 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **12.71** acres @ **49.8%** impervious

**Estimate the surface area required at pond normal pool elevation ==>**

Wet Detention Basins are based on an minimum average depth of = **3.01** feet (*Hard Coded*)

	3.0	3.01	4.0
Lower Boundary =>	40.0	1.51	1.24
Site % impervious =>	49.8	1.78	<b>1.78</b>
Upper Boundary =>	50.0	1.79	1.51

Therefore, SA/DA required = **1.78**

Surface area required for main pool at normal pool = 9,867 ft<sup>2</sup>  
= 0.23 acres

Surface area provided for total normal pool = 12,708 ft<sup>2</sup>

Surface area estimate for main pool at normal pool = 10,166 ft<sup>2</sup>

\*Assume main pool 80% of total normal pool area

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	12.71	acres
Impervious area =	6.33	acres
Percent impervious cover, I =	49.8	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.50 \\ WQ_V &= 0.53 \quad \text{acre-ft} \\ &= 22995 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 22995 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	13101
b =	1.136
$Z_o$ =	380.00
Volume in 1" rainfall =	22995 cf.

***Calculated values:***

Depth of WQv in Basin =	1.64	ft
=	19.69	inches
Elevation =	381.64	ft

**DRAWDOWN ORIFICE DESIGN**

D orifice = **2** inch  
 # orifices = **1**  
 Ks = 13101  
 b = 1.1355  
 C<sub>d</sub> orifice = **0.60**  
 Normal Pool Elevation = 380.00 feet  
 Volume @ Normal Pool = 0 cf  
 Orifice Invert = 380.00 feet  
 WSEL @ 1" Runoff Volume = 381.64 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
381.64	22995	0.131			
381.50	20741	0.125	0.128	2254	17629
381.36	18516	0.118	0.122	2225	18304
381.21	16323	0.112	0.115	2193	19086
381.07	14164	0.104	0.108	2159	20011
380.93	12044	0.096	0.100	2120	21129
380.79	9968	0.088	0.092	2076	22524
380.64	7943	0.079	0.083	2025	24341
380.50	5978	0.068	0.073	1965	26867
380.36	4088	0.055	0.061	1890	30779
380.22	2299	0.038	0.047	1788	38366

Drawdown Time = 2.77 days

By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice = 0.519 feet  
 Orifice composite loss coefficient = **0.600**  
 Cross-sectional area of siphon = 0.022 sf  
 Q = 0.0757 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time = 3.52 days



Subsection: Elevation-Area Volume Curve

Label: SCM A

Return Event: 1 years

Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
380.00	0.0	0.29	0.00	0.000	0.000
381.00	0.0	0.32	0.92	0.308	0.308
382.00	0.0	0.36	1.02	0.340	0.648
383.00	0.0	0.39	1.12	0.374	1.023
384.00	0.0	0.43	1.23	0.410	1.432
385.00	0.0	0.47	1.34	0.446	1.879
386.00	0.0	0.50	1.45	0.484	2.363



Subsection: Outlet Input Data

Label: SCMA

Return Event: 1 years  
Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	380.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	386.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	Riser	Forward	Culvert	383.50	386.00
Orifice-Circular	WQOrifice	Forward	Culvert	380.00	386.00
Culvert-Circular	Culvert	Forward	TW	379.00	386.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert	
Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	24.00 in
Length	50.00 ft
Length (Computed Barrel)	50.01 ft
Slope (Computed)	0.020 ft/ft
<hr/>	
Outlet Control Data	
Manning's n	0.013
Ke	0.2
Kb	0.0
Kr	0.0
Convergence Tolerance	0.00 ft
<hr/>	
Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.1
T2 ratio (HW/D)	1.2
Slope Correction Factor	-0.5

---

Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

T1 Elevation	381.17 ft	T1 Flow	15.6 ft <sup>3</sup> /s
T2 Elevation	381.37 ft	T2 Flow	17.8 ft <sup>3</sup> /s

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Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	383.50 ft
Orifice Area	16.0 ft <sup>2</sup>
Orifice Coefficient	0.6
Weir Length	16.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False
Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	380.00 ft
Orifice Diameter	2.00 in
Orifice Coefficient	0.6
Structure ID: TW	
Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall
Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
380.00	0.0	(N/A)	0.00	(no Q: Riser,WQOrifice,Culvert)
380.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
380.20	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
380.30	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
380.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
380.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
380.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
380.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
380.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
380.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
381.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
381.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
381.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
381.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
381.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
381.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
381.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
381.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
381.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
381.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
382.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
382.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
382.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
382.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
382.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
382.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
382.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
382.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
382.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
382.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
383.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
383.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
383.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
383.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
383.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
383.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
383.60	1.7	(N/A)	0.00	Riser,WQOrifice,Culvert
383.70	4.5	(N/A)	0.00	Riser,WQOrifice,Culvert
383.80	8.1	(N/A)	0.00	Riser,WQOrifice,Culvert
383.90	12.3	(N/A)	0.00	Riser,WQOrifice,Culvert
384.00	17.1	(N/A)	0.00	Riser,WQOrifice,Culvert
384.10	22.4	(N/A)	0.00	Riser,WQOrifice,Culvert
384.20	28.2	(N/A)	0.00	Riser,WQOrifice,Culvert
384.30	34.4	(N/A)	0.00	Riser,WQOrifice,Culvert
384.40	35.5	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
384.50	35.9	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
384.60	36.3	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
384.70	36.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
384.80	37.2	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
384.90	37.6	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
385.00	38.0	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
385.10	38.4	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
385.20	38.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
385.30	39.2	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
385.40	39.6	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
385.50	40.0	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)



Subsection: Composite Rating Curve

Label: SCMA

Return Event: 1 years

Storm Event: 1 yr

#### Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
385.60	40.4	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
385.70	40.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
385.80	41.2	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
385.90	41.5	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
386.00	41.9	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)



Subsection: Level Pool Pond Routing Summary

Label: SCM A (IN)

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	380.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

---

---

#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	22.5 ft <sup>3</sup> /s	Time to Peak (Flow, In)	722.00 min
Flow (Peak Outlet)	0.2 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	1,440.00 min

---

Elevation (Water Surface, Peak)	382.76 ft
Volume (Peak)	0.930 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.089 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.160 ac-ft
Volume (Retained)	0.929 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM A (IN)

Return Event: 10 years

Storm Event: 10 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	380.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	53.2 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	13.2 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	752.00 min

---

Elevation (Water Surface, Peak)	383.92 ft
Volume (Peak)	1.397 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	2.922 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.683 ac-ft
Volume (Retained)	1.238 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM A (IN)

Return Event: 25 years

Storm Event: 25 yr

---

#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

---

---

#### Initial Conditions

---

Elevation (Water Surface, Initial)	380.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	64.9 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	25.1 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	730.00 min

---

Elevation (Water Surface, Peak)	384.15 ft
Volume (Peak)	1.495 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.804 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.563 ac-ft
Volume (Retained)	1.241 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM A (IN)

Return Event: 100 years

Storm Event: 100 yr

---

#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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---

#### Initial Conditions

---

Elevation (Water Surface, Initial)	380.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	82.0 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	37.6 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	729.00 min

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Elevation (Water Surface, Peak)	384.90 ft
Volume (Peak)	1.834 ac-ft

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#### Mass Balance (ac-ft)

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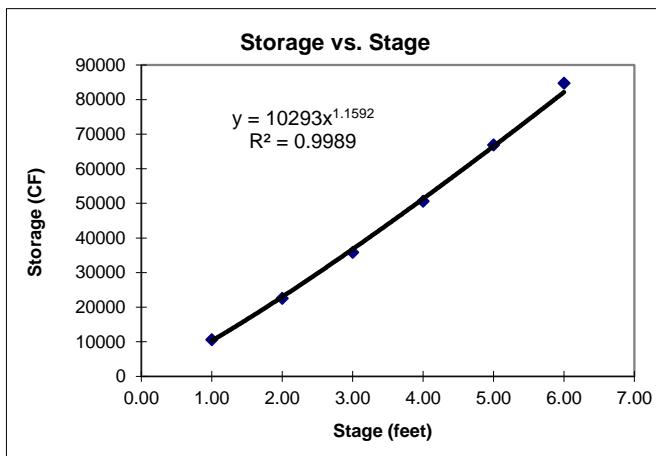
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	5.314 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	4.071 ac-ft
Volume (Retained)	1.242 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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*STORMWATER CONTROL MEASURE 'B'*  
*DESIGN CALCULATIONS*

**STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
376.00	0.00	9,911				
377.00	1.00	11,230	10571	10571	10571	1.02
378.00	2.00	12,604	11917	11917	22488	1.96
379.00	3.00	14,034	13319	13319	35807	2.93
380.00	4.00	15,521	14778	14778	50584	3.95
381.00	5.00	17,064	16293	16293	66877	5.02
382.00	6.00	18,664	17864	17864	84741	6.16



$K_s =$	10293
$b =$	1.1592

**WET DETENTION BASIN SUMMARY**

**Enter the drainage area characteristics ==>**

Total drainage area to pond = 10.54 acres  
Total impervious area to pond = 7.21 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **10.54** acres @ **68.4%** impervious

**Estimate the surface area required at pond normal pool elevation ==>**

Wet Detention Basins are based on an minimum average depth of = **4.01** feet (*Hard Coded*)

	4.0	4.01	5.0
Lower Boundary =>	60.0	1.77	1.49
Site % impervious =>	68.4	2.04	1.75
Upper Boundary =>	70.0	2.09	1.80

Therefore, SA/DA required = **2.04**

Surface area required for main pool at normal pool = 9,345 ft<sup>2</sup>  
= 0.21 acres

Surface area provided for total normal pool = 9,911 ft<sup>2</sup>

Surface area estimate for main pool at normal pool = 7,929 ft<sup>2</sup>

\*Assume main pool 80% of total normal pool area

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	10.54	acres
Impervious area =	7.21	acres
Percent impervious cover, I =	68.4	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.67 \\ WQ_V &= 0.58 \quad \text{acre-ft} \\ &= 25460 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 25460 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	10293
b =	1.159
$Z_o$ =	376.00
Volume in 1" rainfall =	25460 cf.

***Calculated values:***

$$\begin{aligned} \text{Depth of } WQ_V \text{ in Basin} &= 2.18 \quad \text{ft} \\ &= 26.21 \quad \text{inches} \\ \text{Elevation} &= 378.18 \quad \text{ft} \end{aligned}$$

**DRAWDOWN ORIFICE DESIGN**

D orifice =	2 inch
# orifices =	1
Ks =	10293
b =	1.1592
C <sub>d</sub> orifice =	0.60
Normal Pool Elevation =	376.00 feet
Volume @ Normal Pool =	0 cf
Orifice Invert =	376.00 feet
WSEL @ 1" Runoff Volume =	378.18 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
378.18	25460	0.152			
378.00	22932	0.145	0.149	2528	17023
377.81	20441	0.138	0.141	2491	17618
377.62	17991	0.130	0.134	2450	18303
377.43	15587	0.122	0.126	2405	19107
377.24	13232	0.113	0.117	2355	20071
377.05	10934	0.103	0.108	2298	21260
376.87	8701	0.093	0.098	2233	22785
376.68	6544	0.081	0.087	2157	24859
376.49	4482	0.067	0.074	2062	27958
376.30	2546	0.049	0.058	1936	33525

Drawdown Time = 2.58 days

By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.700 feet
Orifice composite loss coefficient =	0.600
Cross-sectional area of siphon =	0.022 sf
Q =	0.0879 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time = 3.35 days



Subsection: Elevation-Area Volume Curve

Label: SCM B

Return Event: 1 years  
Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
376.00	0.0	0.23	0.00	0.000	0.000
377.00	0.0	0.26	0.73	0.243	0.243
378.00	0.0	0.29	0.82	0.273	0.516
379.00	0.0	0.32	0.92	0.306	0.822
380.00	0.0	0.36	1.02	0.339	1.161
381.00	0.0	0.39	1.12	0.374	1.535
382.00	0.0	0.43	1.23	0.410	1.944



Subsection: Outlet Input Data

Label: SCMB

Return Event: 1 years

Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	376.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	382.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	Riser	Forward	Culvert	379.00	382.00
Orifice-Circular	WQOrifice	Forward	Culvert	376.00	382.00
Culvert-Circular	Culvert	Forward	TW	375.00	382.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert	
Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	24.00 in
Length	50.00 ft
Length (Computed Barrel)	50.01 ft
Slope (Computed)	0.020 ft/ft
<hr/>	
Outlet Control Data	
Manning's n	0.013
Ke	0.2
Kb	0.0
Kr	0.0
Convergence Tolerance	0.00 ft
<hr/>	
Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.1
T2 ratio (HW/D)	1.2
Slope Correction Factor	-0.5

---

Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

T1 Elevation	377.17 ft	T1 Flow	15.6 ft <sup>3</sup> /s
T2 Elevation	377.37 ft	T2 Flow	17.8 ft <sup>3</sup> /s

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Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	379.00 ft
Orifice Area	16.0 ft <sup>2</sup>
Orifice Coefficient	0.6
Weir Length	16.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False
Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	376.00 ft
Orifice Diameter	2.00 in
Orifice Coefficient	0.6
Structure ID: TW	
Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall
Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
376.00	0.0	(N/A)	0.00	(no Q: Riser,WQOrifice,Culvert)
376.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.20	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.30	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
378.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
379.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
379.10	1.7	(N/A)	0.00	Riser,WQOrifice,Culvert
379.20	4.5	(N/A)	0.00	Riser,WQOrifice,Culvert
379.30	8.1	(N/A)	0.00	Riser,WQOrifice,Culvert
379.40	12.3	(N/A)	0.00	Riser,WQOrifice,Culvert
379.50	17.1	(N/A)	0.00	Riser,WQOrifice,Culvert
379.60	22.4	(N/A)	0.00	Riser,WQOrifice,Culvert
379.70	28.2	(N/A)	0.00	Riser,WQOrifice,Culvert
379.80	32.7	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
379.90	33.2	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.00	33.7	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.10	34.1	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.20	34.6	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.30	35.0	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.40	35.5	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.50	35.9	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.60	36.3	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.70	36.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.80	37.2	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.90	37.6	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.00	38.0	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.10	38.4	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.20	38.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.30	39.2	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.40	39.6	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)



Subsection: Composite Rating Curve

Label: SCMB

Return Event: 1 years

Storm Event: 1 yr

#### Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
381.50	40.0	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.60	40.4	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.70	40.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.80	41.2	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.90	41.5	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
382.00	41.9	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)



Subsection: Level Pool Pond Routing Summary

Label: SCM B (IN)

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	376.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	33.6 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	5.4 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	753.00 min

---

Elevation (Water Surface, Peak)	379.23 ft
Volume (Peak)	0.895 ac-ft

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---

#### Mass Balance (ac-ft)

---

Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.556 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.731 ac-ft
Volume (Retained)	0.825 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM B (IN)

Return Event: 10 years

Storm Event: 10 yr

---

#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	376.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	60.0 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	34.1 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	727.00 min

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Elevation (Water Surface, Peak)	380.10 ft
Volume (Peak)	1.198 ac-ft

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#### Mass Balance (ac-ft)

---

Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.360 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.526 ac-ft
Volume (Retained)	0.832 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM B (IN)

Return Event: 25 years

Storm Event: 25 yr

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#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	376.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	68.9 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	35.9 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	728.00 min

---

Elevation (Water Surface, Peak)	380.51 ft
Volume (Peak)	1.346 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.172 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.337 ac-ft
Volume (Retained)	0.834 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM B (IN)

Return Event: 100 years

Storm Event: 100 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	376.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

---

Flow (Peak In)	81.7 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	37.9 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	728.00 min

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Elevation (Water Surface, Peak)	380.96 ft
Volume (Peak)	1.520 ac-ft

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#### Mass Balance (ac-ft)

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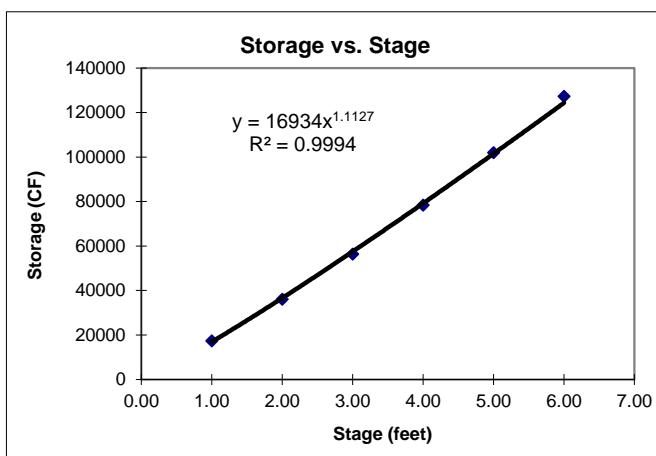
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	5.524 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	4.689 ac-ft
Volume (Retained)	0.834 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---

*STORMWATER CONTROL MEASURE 'C'*  
*DESIGN CALCULATIONS*

**STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
376.00	0.00	16,533				
377.00	1.00	18,005	17269	17269	17269	1.02
378.00	2.00	19,534	18770	18770	36039	1.97
379.00	3.00	21,120	20327	20327	56366	2.95
380.00	4.00	22,761	21941	21941	78306	3.96
381.00	5.00	24,460	23611	23611	101917	5.02
382.00	6.00	26,215	24488	48976	127282	6.13



$K_s =$	16934
$b =$	1.1127

**WET DETENTION BASIN SUMMARY**

*Enter the drainage area characteristics ==>*

Total drainage area to pond = 17.45 acres  
Total impervious area to pond = 10.07 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **17.45** acres @ **57.7%** impervious

*Estimate the surface area required at pond normal pool elevation ==>*

Wet Detention Basins are based on an minimum average depth of = **4.01** feet (*Hard Coded*)

	4.0	4.01	5.0
Lower Boundary =>	50.0	1.51	1.31
Site % impervious =>	57.7	1.71	1.45
Upper Boundary =>	60.0	1.77	1.49

Therefore, SA/DA required = **1.71**

Surface area required for main pool at normal pool = 12,981 ft<sup>2</sup>  
= 0.30 acres

Surface area provided for total normal pool = 16,533 ft<sup>2</sup>

Surface area estimate for main pool at normal pool = 13,226 ft<sup>2</sup>

\*Assume main pool 80% of total normal pool area

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	17.45	acres
Impervious area =	10.07	acres
Percent impervious cover, I =	57.7	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.57 \\ WQ_V &= 0.83 \quad \text{acre-ft} \\ &= 36064 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 36064 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	16934
b =	1.113
$Z_o$ =	376.00
Volume in 1" rainfall =	36064 cf.

***Calculated values:***

$$\begin{aligned} \text{Depth of } WQ_V \text{ in Basin} &= 1.97 \quad \text{ft} \\ &= 23.67 \quad \text{inches} \\ \text{Elevation} &= \textcolor{red}{377.97} \quad \text{ft} \end{aligned}$$

**DRAWDOWN ORIFICE DESIGN**

D orifice =	2.75 inch
# orifices =	1
Ks =	16934
b =	1.1127
C <sub>d</sub> orifice =	0.60
Normal Pool Elevation =	376.00 feet
Volume @ Normal Pool =	0 cf
Orifice Invert =	376.00 feet
WSEL @ 1" Runoff Volume =	377.97 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
377.97	36064	0.270			
377.80	32576	0.257	0.264	3488	13220
377.63	29125	0.244	0.251	3451	13765
377.46	25715	0.230	0.237	3410	14401
377.28	22350	0.214	0.222	3365	15156
377.11	19036	0.198	0.206	3314	16076
376.94	15780	0.180	0.189	3256	17233
376.77	12591	0.160	0.170	3189	18757
376.59	9482	0.137	0.149	3109	20911
376.42	6475	0.110	0.124	3007	24340
376.25	3606	0.073	0.091	2868	31421

Drawdown Time = 2.14 days

By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.619 feet
Orifice composite loss coefficient =	0.600
Cross-sectional area of siphon =	0.041 sf
Q =	0.1563 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time = 2.67 days



Subsection: Elevation-Area Volume Curve

Label: SCM C

Return Event: 1 years  
Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
376.00	0.0	0.38	0.00	0.000	0.000
377.00	0.0	0.41	1.19	0.396	0.396
378.00	0.0	0.45	1.29	0.431	0.827
379.00	0.0	0.48	1.40	0.467	1.294
380.00	0.0	0.52	1.51	0.504	1.797
381.00	0.0	0.56	1.63	0.542	2.339
382.00	0.0	0.60	1.74	0.582	2.921



Subsection: Outlet Input Data

Label: SCMC

Return Event: 1 years  
Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	376.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	382.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	Riser	Forward	Culvert	379.00	382.00
Orifice-Circular	WQOrifice	Forward	Culvert	376.00	382.00
Culvert-Circular	Culvert	Forward	TW	374.50	382.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert	
Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	36.00 in
Length	50.00 ft
Length (Computed Barrel)	50.00 ft
Slope (Computed)	0.010 ft/ft
<hr/>	
Outlet Control Data	
Manning's n	0.013
Ke	0.2
Kb	0.0
Kr	0.0
Convergence Tolerance	0.00 ft
<hr/>	
Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.1
T2 ratio (HW/D)	1.2
Slope Correction Factor	-0.5

---

Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

T1 Elevation	377.77 ft	T1 Flow	42.9 ft <sup>3</sup> /s
T2 Elevation	378.08 ft	T2 Flow	49.0 ft <sup>3</sup> /s

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Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	379.00 ft
Orifice Area	25.0 ft <sup>2</sup>
Orifice Coefficient	0.6
Weir Length	20.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False
Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	376.00 ft
Orifice Diameter	2.75 in
Orifice Coefficient	0.6
Structure ID: TW	
Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall
Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
376.00	0.0	(N/A)	0.00	(no Q: Riser,WQOrifice,Culvert)
376.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
376.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.80	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
377.90	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.00	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.10	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.20	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.30	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.40	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.50	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
378.60	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.70	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.80	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
378.90	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
379.00	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
379.10	2.2	(N/A)	0.00	Riser,WQOrifice,Culvert
379.20	5.7	(N/A)	0.00	Riser,WQOrifice,Culvert
379.30	10.2	(N/A)	0.00	Riser,WQOrifice,Culvert
379.40	15.5	(N/A)	0.00	Riser,WQOrifice,Culvert
379.50	21.5	(N/A)	0.00	Riser,WQOrifice,Culvert
379.60	28.2	(N/A)	0.00	Riser,WQOrifice,Culvert
379.70	35.4	(N/A)	0.00	Riser,WQOrifice,Culvert
379.80	43.2	(N/A)	0.00	Riser,WQOrifice,Culvert
379.90	51.4	(N/A)	0.00	Riser,WQOrifice,Culvert
380.00	60.2	(N/A)	0.00	Riser,WQOrifice,Culvert
380.10	69.3	(N/A)	0.00	Riser,WQOrifice,Culvert
380.20	75.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.30	76.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.40	77.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.50	78.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.60	79.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.70	80.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.80	81.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
380.90	82.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.00	83.7	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.10	84.6	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.20	85.6	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.30	86.5	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.40	87.4	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.50	88.3	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.60	89.2	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)



Subsection: Composite Rating Curve

Label: SCMC

Return Event: 1 years

Storm Event: 1 yr

#### Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
381.70	90.1	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.80	90.9	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
381.90	91.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
382.00	92.6	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)



Subsection: Level Pool Pond Routing Summary

Label: SCM C (IN)

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	376.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	46.0 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	2.2 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	784.00 min

---

Elevation (Water Surface, Peak)	379.10 ft
Volume (Peak)	1.340 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	2.137 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.838 ac-ft
Volume (Retained)	1.298 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM C (IN)

Return Event: 10 years

Storm Event: 10 yr

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#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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---

#### Initial Conditions

---

Elevation (Water Surface, Initial)	376.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	90.2 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	55.7 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	727.00 min

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Elevation (Water Surface, Peak)	379.95 ft
Volume (Peak)	1.771 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.972 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.658 ac-ft
Volume (Retained)	1.313 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM C (IN)

Return Event: 25 years

Storm Event: 25 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	376.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	105.7 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	76.2 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	725.00 min

---

Elevation (Water Surface, Peak)	380.24 ft
Volume (Peak)	1.922 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	6.277 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	4.958 ac-ft
Volume (Retained)	1.317 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM C (IN)

Return Event: 100 years

Storm Event: 100 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	376.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	128.0 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	80.5 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	726.00 min

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Elevation (Water Surface, Peak)	380.66 ft
Volume (Peak)	2.153 ac-ft

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#### Mass Balance (ac-ft)

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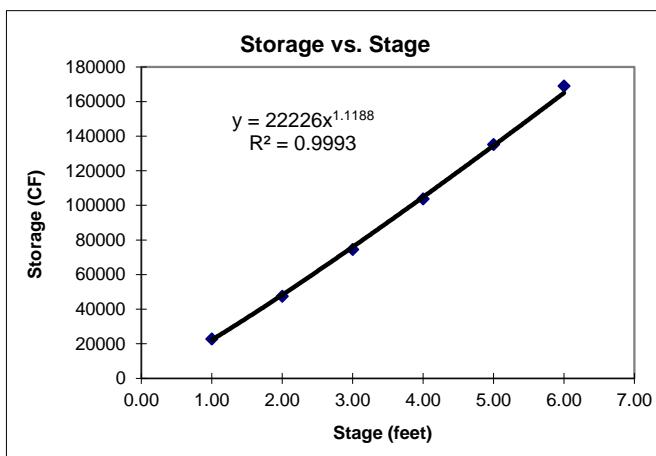
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	8.467 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	7.148 ac-ft
Volume (Retained)	1.318 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

---

*STORMWATER CONTROL MEASURE 'D'*  
*DESIGN CALCULATIONS*

**STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
354.00	0.00	21,630				
355.00	1.00	23,725	22678	22678	22678	1.02
356.00	2.00	25,867	24796	24796	47474	1.97
357.00	3.00	28,067	26967	26967	74441	2.95
358.00	4.00	30,323	29195	29195	103636	3.96
359.00	5.00	32,636	31480	31480	135115	5.02
360.00	6.00	35,005	33821	33821	168936	6.13



$K_s =$	22226
$b =$	1.1188

**WET DETENTION BASIN SUMMARY**

**Enter the drainage area characteristics ==>**

Total drainage area to pond = 13.40 acres  
Total impervious area to pond = 6.79 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **13.40** acres @ **50.7%** impervious

**Estimate the surface area required at pond normal pool elevation ==>**

Wet Detention Basins are based on an minimum average depth of = **3.01** feet (*Hard Coded*)

	3.0	3.01	4.0
Lower Boundary =>	50.0	1.79	1.51
Site % impervious =>	50.7	1.81	1.53
Upper Boundary =>	60.0	2.09	1.77

Therefore, SA/DA required = **1.81**

Surface area required for main pool at normal pool = 10,551 ft<sup>2</sup>  
= 0.24 acres

Surface area provided for total normal pool = 21,630 ft<sup>2</sup>

Surface area estimate for main pool at normal pool = 17,304 ft<sup>2</sup>

\*Assume main pool 80% of total normal pool area

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	13.40	acres
Impervious area =	6.79	acres
Percent impervious cover, I =	50.7	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.51 \\ WQ_V &= 0.57 \quad \text{acre-ft} \\ &= 24618 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 24618 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	22226
b =	1.119
$Z_o$ =	354.00
Volume in 1" rainfall =	24618 cf.

***Calculated values:***

Depth of WQv in Basin =	1.10	ft
=	13.15	inches
Elevation =	355.10	ft

**DRAWDOWN ORIFICE DESIGN**

D orifice =	2.5 inch
# orifices =	1
Ks =	22226
b =	1.1188
C <sub>d</sub> orifice =	0.60
Normal Pool Elevation =	354.00 feet
Volume @ Normal Pool =	0 cf
Orifice Invert =	354.00 feet
WSEL @ 1" Runoff Volume =	355.10 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
355.10	24618	0.163			
355.00	22228	0.155	0.159	2390	15016
354.90	19865	0.147	0.151	2363	15661
354.81	17532	0.138	0.142	2333	16420
354.71	15232	0.128	0.133	2301	17331
354.62	12967	0.117	0.123	2264	18456
354.52	10745	0.106	0.112	2223	19900
354.43	8570	0.093	0.100	2175	21855
354.33	6453	0.078	0.086	2117	24746
354.24	4408	0.059	0.069	2045	29756
354.14	2462	0.029	0.044	1946	43938

Drawdown Time =	2.58 days
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By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.331 feet
Orifice composite loss coefficient =	0.600
Cross-sectional area of siphon =	0.034 sf
Q =	0.0944 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time =	3.02 days
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Subsection: Elevation-Area Volume Curve

Label: SCM D

Return Event: 1 years  
Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
354.00	0.0	0.50	0.00	0.000	0.000
355.00	0.0	0.54	1.56	0.520	0.520
356.00	0.0	0.59	1.71	0.569	1.089
357.00	0.0	0.64	1.86	0.619	1.708
358.00	0.0	0.70	2.01	0.670	2.378
359.00	0.0	0.75	2.17	0.722	3.101
360.00	0.0	0.80	2.33	0.776	3.877



Subsection: Outlet Input Data

Label: SCMD

Return Event: 1 years

Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	354.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	360.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	Riser	Forward	Culvert	358.00	360.00
Orifice-Circular	WQOrifice	Forward	Culvert	354.00	360.00
Culvert-Circular	Culvert	Forward	TW	353.00	360.00
Tailwater Settings	Tailwater			(N/A)	(N/A)



Subsection: Outlet Input Data

Label: SCMD

Return Event: 1 years  
Storm Event: 1 yr

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Structure ID: Culvert  
Structure Type: Culvert-Circular

---

Number of Barrels	1
Diameter	24.00 in
Length	50.00 ft
Length (Computed Barrel)	50.01 ft
Slope (Computed)	0.020 ft/ft

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Outlet Control Data

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Manning's n	0.013
Ke	0.2
Kb	0.0
Kr	0.0
Convergence Tolerance	0.00 ft

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Inlet Control Data

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Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.1
T2 ratio (HW/D)	1.2
Slope Correction Factor	-0.5

---

Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

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T1 Elevation	355.17 ft	T1 Flow	15.6 ft <sup>3</sup> /s
T2 Elevation	355.37 ft	T2 Flow	17.8 ft <sup>3</sup> /s

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Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	358.00 ft
Orifice Area	16.0 ft <sup>2</sup>
Orifice Coefficient	0.6
Weir Length	16.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False
Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	354.00 ft
Orifice Diameter	2.50 in
Orifice Coefficient	0.6
Structure ID: TW	
Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall
Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
354.00	0.0	(N/A)	0.00	(no Q: Riser,WQOrifice,Culvert)
354.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
354.20	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
354.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
354.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
354.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
354.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
354.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
354.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
354.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
355.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
355.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
355.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
355.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
355.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
355.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
355.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
355.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
355.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
355.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
356.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
356.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
356.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
356.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
356.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
356.50	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
356.60	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
356.70	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
356.80	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
356.90	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
357.00	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
357.10	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
357.20	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
357.30	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
357.40	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
357.50	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
357.60	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
357.70	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
357.80	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
357.90	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
358.00	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
358.10	1.8	(N/A)	0.00	Riser,WQOrifice,Culvert
358.20	4.6	(N/A)	0.00	Riser,WQOrifice,Culvert
358.30	8.2	(N/A)	0.00	Riser,WQOrifice,Culvert
358.40	12.4	(N/A)	0.00	Riser,WQOrifice,Culvert
358.50	17.2	(N/A)	0.00	Riser,WQOrifice,Culvert
358.60	22.6	(N/A)	0.00	Riser,WQOrifice,Culvert
358.70	28.3	(N/A)	0.00	Riser,WQOrifice,Culvert
358.80	34.5	(N/A)	0.00	Riser,WQOrifice,Culvert
358.90	37.6	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
359.00	38.0	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
359.10	38.4	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
359.20	38.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
359.30	39.2	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
359.40	39.6	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
359.50	40.0	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)



Subsection: Composite Rating Curve

Label: SCMD

Return Event: 1 years

Storm Event: 1 yr

#### Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
359.60	40.4	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
359.70	40.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
359.80	41.2	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
359.90	41.5	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
360.00	41.9	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)



Subsection: Level Pool Pond Routing Summary

Label: SCM D (IN)

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	354.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	26.8 ft <sup>3</sup> /s	Time to Peak (Flow, In)	722.00 min
Flow (Peak Outlet)	0.2 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	1,440.00 min

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Elevation (Water Surface, Peak)	355.96 ft
Volume (Peak)	1.068 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.278 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.209 ac-ft
Volume (Retained)	1.068 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM D (IN)

Return Event: 10 years

Storm Event: 10 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	354.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	59.9 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	1.5 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	905.00 min

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Elevation (Water Surface, Peak)	358.08 ft
Volume (Peak)	2.434 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.284 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.882 ac-ft
Volume (Retained)	2.401 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM D (IN)

Return Event: 25 years

Storm Event: 25 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	354.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	72.2 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	6.5 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	781.00 min

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Elevation (Water Surface, Peak)	358.25 ft
Volume (Peak)	2.556 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.237 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.829 ac-ft
Volume (Retained)	2.406 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM D (IN)

Return Event: 100 years

Storm Event: 100 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	354.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	90.1 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	25.3 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	752.00 min

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Elevation (Water Surface, Peak)	358.65 ft
Volume (Peak)	2.840 ac-ft

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#### Mass Balance (ac-ft)

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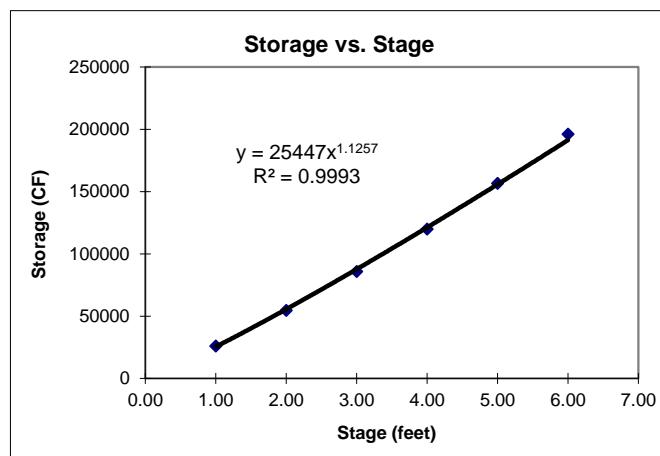
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	5.858 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.448 ac-ft
Volume (Retained)	2.408 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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*STORMWATER CONTROL MEASURE 'E'*  
*DESIGN CALCULATIONS*

**STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
358.00	0.00	24,701				
359.00	1.00	27,273	25987	25987	25987	1.02
360.00	2.00	29,898	28586	28586	54573	1.97
361.00	3.00	32,580	31239	31239	85812	2.94
362.00	4.00	35,318	33949	33949	119761	3.96
363.00	5.00	38,114	36716	36716	156477	5.02
364.00	6.00	40,965	39540	39540	196016	6.13



$K_s =$	25447
$b =$	1.1257

**WET DETENTION BASIN SUMMARY**

**Enter the drainage area characteristics ==>**

Total drainage area to pond = 12.25 acres  
Total impervious area to pond = 6.96 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **12.25** acres @ **56.8%** impervious

**Estimate the surface area required at pond normal pool elevation ==>**

Wet Detention Basins are based on an minimum average depth of = **3.01** feet (*Hard Coded*)

	3.0	3.01	4.0
Lower Boundary =>	50.0	1.79	1.51
Site % impervious =>	56.8	1.99	1.69
Upper Boundary =>	60.0	2.09	1.77

Therefore, SA/DA required = **1.99**

Surface area required for main pool at normal pool = 10,631 ft<sup>2</sup>  
= 0.24 acres

Surface area provided for total normal pool = 24,701 ft<sup>2</sup>

Surface area estimate for main pool at normal pool = 19,761 ft<sup>2</sup>

\*Assume main pool 80% of total normal pool area

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	12.25	acres
Impervious area =	6.96	acres
Percent impervious cover, I =	56.8	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.56 \\ WQ_V &= 0.57 \quad \text{acre-ft} \\ &= 24972 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 24972 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	25447
b =	1.126
$Z_o$ =	358.00
Volume in 1" rainfall =	24972 cf.

***Calculated values:***

Depth of WQv in Basin =	0.98	ft
=	11.80	inches
Elevation =	358.98	ft

**DRAWDOWN ORIFICE DESIGN**

D orifice = **2** inch  
 # orifices = **1**  
 Ks = **25447**  
 b = **1.1257**  
 Cd orifice = **0.60**  
 Normal Pool Elevation = **358.00** feet  
 Volume @ Normal Pool = **0** cf  
 Orifice Invert = **358.00** feet  
 WSEL @ 1" Runoff Volume = **358.98** feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
358.98	24972	0.100			
358.90	22538	0.095	0.097	2434	25071
358.81	20133	0.090	0.092	2405	26112
358.73	17760	0.084	0.087	2373	27332
358.64	15422	0.078	0.081	2338	28789
358.56	13123	0.072	0.075	2299	30579
358.47	10868	0.065	0.069	2255	32859
358.38	8665	0.058	0.061	2203	35915
358.30	6523	0.049	0.053	2142	40357
358.21	4458	0.038	0.043	2065	47817
358.13	2497	0.020	0.029	1961	67630

Drawdown Time = **4.20** days

By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice = **0.300** feet  
 Orifice composite loss coefficient = **0.600**  
 Cross-sectional area of siphon = **0.022** sf  
 Q = **0.0575** cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time = **5.02** days



Subsection: Elevation-Area Volume Curve

Label: SCM E

Return Event: 1 years

Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
358.00	0.0	0.57	0.00	0.000	0.000
359.00	0.0	0.63	1.79	0.596	0.596
360.00	0.0	0.69	1.97	0.656	1.252
361.00	0.0	0.75	2.15	0.717	1.969
362.00	0.0	0.81	2.34	0.779	2.748
363.00	0.0	0.87	2.53	0.843	3.591
364.00	0.0	0.94	2.72	0.908	4.499

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
358.00	0.0	(N/A)	0.00	(no Q: Riser,WQOrifice,Culvert)
358.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
358.20	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
358.30	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
358.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
358.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
358.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
358.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
358.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
358.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
359.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
359.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
359.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
359.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
359.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
359.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
359.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
359.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
359.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
359.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
360.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
360.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
360.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
360.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
360.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
360.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
360.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
360.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
360.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
360.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
361.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
361.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
361.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
361.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
361.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
361.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
361.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
361.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
361.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
361.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
362.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
362.10	1.7	(N/A)	0.00	Riser,WQOrifice,Culvert
362.20	4.5	(N/A)	0.00	Riser,WQOrifice,Culvert
362.30	8.1	(N/A)	0.00	Riser,WQOrifice,Culvert
362.40	12.3	(N/A)	0.00	Riser,WQOrifice,Culvert
362.50	17.1	(N/A)	0.00	Riser,WQOrifice,Culvert
362.60	22.5	(N/A)	0.00	Riser,WQOrifice,Culvert
362.70	28.2	(N/A)	0.00	Riser,WQOrifice,Culvert
362.80	34.4	(N/A)	0.00	Riser,WQOrifice,Culvert
362.90	37.6	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
363.00	38.0	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
363.10	38.4	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
363.20	38.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
363.30	39.2	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
363.40	39.6	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
363.50	40.0	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)



Subsection: Composite Rating Curve

Label: SCME

Return Event: 1 years

Storm Event: 1 yr

#### Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
363.60	40.4	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
363.70	40.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
363.80	41.2	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
363.90	41.5	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
364.00	41.9	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)



Subsection: Outlet Input Data

Label: SCME

Return Event: 10 years  
Storm Event: 10 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	358.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	364.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	Riser	Forward	Culvert	362.00	364.00
Orifice-Circular	WQOrifice	Forward	Culvert	358.00	364.00
Culvert-Circular	Culvert	Forward	TW	357.00	364.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert	
Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	24.00 in
Length	50.00 ft
Length (Computed Barrel)	50.01 ft
Slope (Computed)	0.020 ft/ft
<hr/>	
Outlet Control Data	
Manning's n	0.013
Ke	0.2
Kb	0.0
Kr	0.0
Convergence Tolerance	0.00 ft
<hr/>	
Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.1
T2 ratio (HW/D)	1.2
Slope Correction Factor	-0.5

---

Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

T1 Elevation	359.17 ft	T1 Flow	15.6 ft <sup>3</sup> /s
T2 Elevation	359.37 ft	T2 Flow	17.8 ft <sup>3</sup> /s

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Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	362.00 ft
Orifice Area	16.0 ft <sup>2</sup>
Orifice Coefficient	0.6
Weir Length	16.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False
Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	358.00 ft
Orifice Diameter	2.00 in
Orifice Coefficient	0.6
Structure ID: TW	
Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall
Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s



Subsection: Level Pool Pond Routing Summary

Label: SCM E (IN)

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	358.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	35.6 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	0.2 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	1,440.00 min

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Elevation (Water Surface, Peak)	360.35 ft
Volume (Peak)	1.498 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.649 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.151 ac-ft
Volume (Retained)	1.498 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM E (IN)

Return Event: 10 years

Storm Event: 10 yr

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#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	358.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	66.6 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	1.8 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	904.00 min

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Elevation (Water Surface, Peak)	362.10 ft
Volume (Peak)	2.831 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.695 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.913 ac-ft
Volume (Retained)	2.780 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM E (IN)

Return Event: 25 years

Storm Event: 25 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	358.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	77.2 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	6.5 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	781.00 min

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Elevation (Water Surface, Peak)	362.26 ft
Volume (Peak)	2.959 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.626 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.838 ac-ft
Volume (Retained)	2.786 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM E (IN)

Return Event: 100 years

Storm Event: 100 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	358.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	92.6 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	24.4 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	752.00 min

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Elevation (Water Surface, Peak)	362.63 ft
Volume (Peak)	3.274 ac-ft

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#### Mass Balance (ac-ft)

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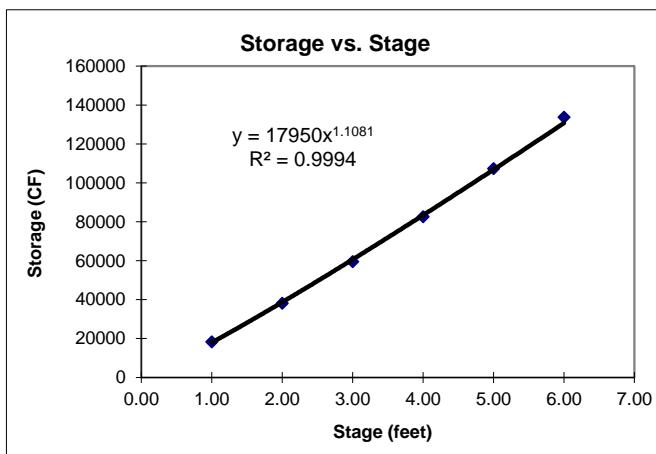
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	6.182 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.393 ac-ft
Volume (Retained)	2.787 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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*STORMWATER CONTROL MEASURE 'F'*  
*DESIGN CALCULATIONS*

**STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
344.00	0.00	17,546				
345.00	1.00	19,038	18292	18292	18292	1.02
346.00	2.00	20,586	19812	19812	38104	1.97
347.00	3.00	22,190	21388	21388	59492	2.95
348.00	4.00	23,851	23021	23021	82513	3.96
349.00	5.00	25,568	24710	24710	107222	5.02
350.00	6.00	27,343	25597	51194	133707	6.12



$K_s = 17950$ $b = 1.1081$
-------------------------------

**WET DETENTION BASIN SUMMARY**

*Enter the drainage area characteristics ==>*

Total drainage area to pond = 23.05 acres  
Total impervious area to pond = 14.96 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **23.05** acres @ **64.9%** impervious

*Estimate the surface area required at pond normal pool elevation ==>*

Wet Detention Basins are based on an minimum average depth of = **4.01** feet (*Hard Coded*)

	4.0	4.01	5.0
Lower Boundary =>	60.0	1.77	1.49
Site % impervious =>	64.9	1.93	1.64
Upper Boundary =>	70.0	2.09	1.80

Therefore, SA/DA required = **1.92**

Surface area required for main pool at normal pool = 19,322 ft<sup>2</sup>  
= 0.44 acres

Surface area provided for total normal pool = 17,546 ft<sup>2</sup>

Surface area estimate for main pool at normal pool = 14,037 ft<sup>2</sup>

\*Assume main pool 80% of total normal pool area

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	23.05	acres
Impervious area =	14.96	acres
Percent impervious cover, I =	64.9	%
Rainfall, P =	1.00	inches

***Calculated values:***

$R_V =$	0.63	
$WQ_V =$	1.22	acre-ft
=	53065	cf.

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 53065 \text{ cf.}$$

***Stage / Storage Data:***

$K_s =$	17950	
$b =$	1.108	
$Z_o =$	344.00	
Volume in 1" rainfall =	53065	cf.

***Calculated values:***

Depth of WQv in Basin =	2.66	ft
=	31.92	inches
Elevation =	346.66	ft

**DRAWDOWN ORIFICE DESIGN**

D orifice =	3 inch
# orifices =	1
Ks =	17950
b =	1.1081
C <sub>d</sub> orifice =	0.60
Normal Pool Elevation =	344.00 feet
Volume @ Normal Pool =	0 cf
Orifice Invert =	344.00 feet
WSEL @ 1" Runoff Volume =	346.66 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
346.66	53065	0.376			
346.43	47946	0.358	0.367	5119	13954
346.19	42880	0.339	0.349	5066	14527
345.96	37871	0.320	0.330	5008	15194
345.73	32927	0.299	0.309	4944	15984
345.50	28054	0.276	0.288	4873	16943
345.26	23263	0.252	0.264	4791	18144
345.03	18567	0.225	0.238	4696	19715
344.80	13984	0.194	0.209	4582	21912
344.57	9546	0.157	0.175	4438	25341
344.33	5307	0.108	0.132	4240	32088

Drawdown Time = 2.24 days

By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.845 feet
Orifice composite loss coefficient =	0.600
Cross-sectional area of siphon =	0.049 sf
Q =	0.2172 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time = 2.83 days



Subsection: Elevation-Area Volume Curve

Label: SCM F

Return Event: 1 years

Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
344.00	0.0	0.40	0.00	0.000	0.000
345.00	0.0	0.44	1.26	0.420	0.420
346.00	0.0	0.47	1.36	0.455	0.875
347.00	0.0	0.51	1.47	0.491	1.365
348.00	0.0	0.55	1.59	0.528	1.894
349.00	0.0	0.59	1.70	0.567	2.461
350.00	0.0	0.63	1.82	0.607	3.068



Subsection: Outlet Input Data

Label: SCMF

Return Event: 1 years  
Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	344.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	350.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Weir - 1	Forward	Culvert	346.80	350.00
Inlet Box	Riser	Forward	Culvert	347.00	350.00
Orifice-Circular	WQOrifice	Forward	Culvert	344.00	350.00
Culvert-Circular	Culvert	Forward	TW	342.50	350.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert	
Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	42.00 in
Length	50.00 ft
Length (Computed Barrel)	50.00 ft
Slope (Computed)	0.010 ft/ft
<hr/>	
Outlet Control Data	
Manning's n	0.013
Ke	0.2
Kb	0.0
Kr	0.0
Convergence Tolerance	0.00 ft
<hr/>	
Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.1
T2 ratio (HW/D)	1.2
Slope Correction Factor	-0.5

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Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

T1 Elevation	346.32 ft	T1 Flow	63.0 ft <sup>3</sup> /s
T2 Elevation	346.67 ft	T2 Flow	72.0 ft <sup>3</sup> /s

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Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	347.00 ft
Orifice Area	36.0 ft <sup>2</sup>
Orifice Coefficient	0.6
Weir Length	24.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False
Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	344.00 ft
Orifice Diameter	3.00 in
Orifice Coefficient	0.6
Structure ID: Weir - 1	
Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	346.80 ft
Weir Length	12.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
Structure ID: TW	
Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall
Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
344.00	0.0	(N/A)	0.00	(no Q: Weir - 1,Riser,WQOrifice,Culvert)
344.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
344.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
344.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
344.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
344.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
344.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
344.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
344.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
344.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
345.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
345.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
345.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
345.30	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
345.40	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
345.50	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
345.60	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
345.70	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
345.80	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
345.90	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
346.00	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
346.10	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
346.20	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
346.30	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
346.40	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
346.50	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
346.60	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
346.70	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
346.80	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Weir - 1,Riser)
346.90	1.5	(N/A)	0.00	Weir - 1,WQOrifice,Culvert (no Q: Riser)
347.00	3.6	(N/A)	0.00	Weir - 1,WQOrifice,Culvert (no Q: Riser)
347.10	8.6	(N/A)	0.00	Weir - 1,Riser,WQOrifice,Culvert
347.20	15.9	(N/A)	0.00	Weir - 1,Riser,WQOrifice,Culvert
347.30	24.9	(N/A)	0.00	Weir - 1,Riser,WQOrifice,Culvert
347.40	35.3	(N/A)	0.00	Weir - 1,Riser,WQOrifice,Culvert
347.50	46.8	(N/A)	0.00	Weir - 1,Riser,WQOrifice,Culvert
347.60	59.5	(N/A)	0.00	Weir - 1,Riser,WQOrifice,Culvert
347.70	73.1	(N/A)	0.00	Weir - 1,Riser,WQOrifice,Culvert
347.80	82.9	(N/A)	0.00	Weir - 1,Riser,WQOrifice,Culvert
347.90	89.2	(N/A)	0.00	Weir - 1,Riser,WQOrifice,Culvert
348.00	93.5	(N/A)	0.00	Weir - 1,Riser,WQOrifice,Culvert
348.10	96.3	(N/A)	0.00	Weir - 1,Riser,WQOrifice,Culvert
348.20	98.2	(N/A)	0.00	Weir - 1,Riser,WQOrifice,Culvert
348.30	99.7	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
348.40	101.1	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
348.50	102.6	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
348.60	104.0	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
348.70	105.4	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
348.80	106.7	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
348.90	108.1	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
349.00	109.5	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
349.10	110.8	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
349.20	112.1	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
349.30	113.4	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
349.40	114.7	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
349.50	115.9	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
349.60	117.2	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
349.70	118.4	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
349.80	119.6	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
349.90	120.9	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)
350.00	122.1	(N/A)	0.00	Riser,Culvert (no Q: Weir - 1,WQOrifice)



Subsection: Level Pool Pond Routing Summary

Label: SCM F (IN)

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	344.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	73.6 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	23.7 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	730.00 min

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Elevation (Water Surface, Peak)	347.29 ft
Volume (Peak)	1.513 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.403 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.121 ac-ft
Volume (Retained)	1.281 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM F (IN)

Return Event: 10 years

Storm Event: 10 yr

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#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	344.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	131.2 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	96.6 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	725.00 min

---

Elevation (Water Surface, Peak)	348.12 ft
Volume (Peak)	1.958 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	7.347 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	6.031 ac-ft
Volume (Retained)	1.314 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM F (IN)

Return Event: 25 years

Storm Event: 25 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	344.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	150.7 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	101.2 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	726.00 min

---

Elevation (Water Surface, Peak)	348.41 ft
Volume (Peak)	2.119 ac-ft

---

---

#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	9.123 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	7.803 ac-ft
Volume (Retained)	1.318 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM F (IN)

Return Event: 100 years

Storm Event: 100 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	344.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	178.7 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	107.7 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	727.00 min

---

Elevation (Water Surface, Peak)	348.87 ft
Volume (Peak)	2.384 ac-ft

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#### Mass Balance (ac-ft)

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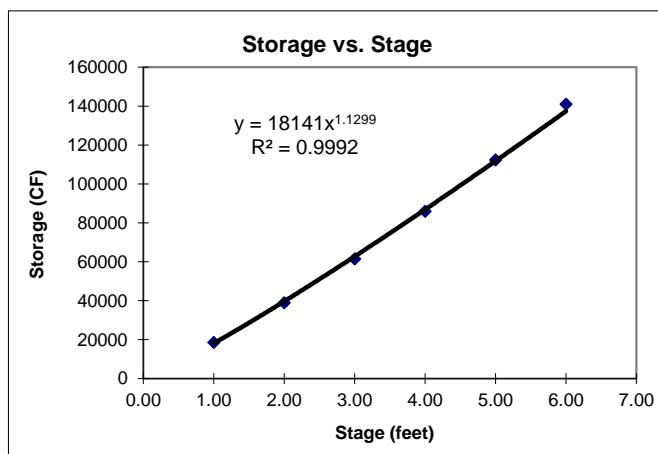
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	12.081 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	10.760 ac-ft
Volume (Retained)	1.319 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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*STORMWATER CONTROL MEASURE 'G'*  
*DESIGN CALCULATIONS*

**STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
342.00	0.00	17,615				
343.00	1.00	19,477	18546	18546	18546	1.02
344.00	2.00	21,407	20442	20442	38988	1.97
345.00	3.00	23,397	22402	22402	61390	2.94
346.00	4.00	25,454	24426	24426	85816	3.96
347.00	5.00	27,572	26513	26513	112329	5.02
348.00	6.00	29,759	28666	28666	140994	6.14



$K_s =$ $b =$	18141 1.1299
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**WET DETENTION BASIN SUMMARY**

**Enter the drainage area characteristics ==>**

Total drainage area to pond = 13.48 acres  
Total impervious area to pond = 9.11 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **13.48** acres @ **67.6%** impervious

**Estimate the surface area required at pond normal pool elevation ==>**

Wet Detention Basins are based on an minimum average depth of = **3.01** feet (*Hard Coded*)

	3.0	3.01	4.0
Lower Boundary =>	60.0	2.09	1.77
Site % impervious =>	67.6	2.41	2.01
Upper Boundary =>	70.0	2.51	2.09

Therefore, SA/DA required = **2.41**

Surface area required for main pool at normal pool = 14,125 ft<sup>2</sup>  
= 0.32 acres

Surface area provided for total normal pool = 17,615 ft<sup>2</sup>

Surface area estimate for main pool at normal pool = 14,092 ft<sup>2</sup>

\*Assume main pool 80% of total normal pool area

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	13.48	acres
Impervious area =	9.11	acres
Percent impervious cover, I =	67.6	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.66 \\ WQ_V &= 0.74 \quad \text{acre-ft} \\ &= 32217 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 32217 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	18141
b =	1.130
$Z_o$ =	342.00
Volume in 1" rainfall =	32217 cf.

***Calculated values:***

Depth of WQv in Basin =	1.66	ft
=	19.95	inches
Elevation =	343.66	ft

**DRAWDOWN ORIFICE DESIGN**

D orifice = **2.75** inch  
 # orifices = **1**  
 Ks = 18141  
 b = 1.1299  
 C<sub>d</sub> orifice = **0.60**  
 Normal Pool Elevation = 342.00 feet  
 Volume @ Normal Pool = 0 cf  
 Orifice Invert = 342.00 feet  
 WSEL @ 1" Runoff Volume = 343.66 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
343.66	32217	0.247			
343.52	29070	0.235	0.241	3148	13072
343.37	25961	0.222	0.229	3109	13595
343.23	22895	0.209	0.216	3066	14205
343.08	19875	0.195	0.202	3020	14930
342.94	16907	0.180	0.188	2968	15814
342.79	13998	0.164	0.172	2909	16929
342.65	11157	0.145	0.154	2841	18404
342.51	8398	0.124	0.135	2759	20502
342.36	5741	0.098	0.111	2657	23886
342.22	3222	0.062	0.080	2519	31419

Drawdown Time = 2.12 days

By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice = 0.516 feet  
 Orifice composite loss coefficient = **0.600**  
 Cross-sectional area of siphon = 0.041 sf  
 Q = 0.1427 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time = 2.61 days



Subsection: Elevation-Area Volume Curve

Label: SCM G

Return Event: 1 years

Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
342.00	0.0	0.40	0.00	0.000	0.000
343.00	0.0	0.45	1.28	0.426	0.426
344.00	0.0	0.49	1.41	0.469	0.895
345.00	0.0	0.54	1.54	0.514	1.409
346.00	0.0	0.58	1.68	0.561	1.969
347.00	0.0	0.63	1.83	0.608	2.578
348.00	0.0	0.68	1.97	0.658	3.236



Subsection: Outlet Input Data

Label: SCMG

Return Event: 1 years  
Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	342.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	348.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Orifice-Circular	Orifice - 2	Forward	Culvert	343.80	348.00
Inlet Box	Riser	Forward	Culvert	346.00	348.00
Orifice-Circular	WQOrifice	Forward	Culvert	342.00	348.00
Culvert-Circular	Culvert	Forward	TW	340.50	348.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert	
Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	36.00 in
Length	50.00 ft
Length (Computed Barrel)	50.00 ft
Slope (Computed)	0.010 ft/ft
<hr/>	
Outlet Control Data	
Manning's n	0.013
Ke	0.2
Kb	0.0
Kr	0.0
Convergence Tolerance	0.00 ft
<hr/>	
Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.1
T2 ratio (HW/D)	1.2
Slope Correction Factor	-0.5

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Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

T1 Elevation	343.77 ft	T1 Flow	42.9 ft <sup>3</sup> /s
T2 Elevation	344.08 ft	T2 Flow	49.0 ft <sup>3</sup> /s

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Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	346.00 ft
Orifice Area	25.0 ft <sup>2</sup>
Orifice Coefficient	0.6
Weir Length	20.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False
Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	342.00 ft
Orifice Diameter	2.75 in
Orifice Coefficient	0.6
Structure ID: Orifice - 2	
Structure Type: Orifice-Circular	
Number of Openings	2
Elevation	343.80 ft
Orifice Diameter	6.00 in
Orifice Coefficient	0.6
Structure ID: TW	
Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall
Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
342.00	0.0	(N/A)	0.00	(no Q: Orifice - 2,Riser,WQOrifice,Culvert)
342.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
342.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
342.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
342.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
342.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
342.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
342.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
342.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
342.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
343.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
343.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
343.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
343.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
343.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
343.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
343.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
343.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
343.80	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
343.90	0.3	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
344.00	0.4	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
344.10	0.7	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
344.20	0.9	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
344.30	1.2	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
344.40	1.4	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
344.50	1.6	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
344.60	1.7	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
344.70	1.8	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
344.80	2.0	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
344.90	2.1	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
345.00	2.2	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
345.10	2.3	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
345.20	2.4	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
345.30	2.5	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
345.40	2.6	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
345.50	2.6	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
345.60	2.7	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
345.70	2.8	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
345.80	2.9	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
345.90	3.0	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
346.00	3.0	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
346.10	5.0	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
346.20	8.5	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
346.30	13.1	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
346.40	18.5	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
346.50	24.5	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
346.60	31.2	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
346.70	38.5	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
346.80	46.4	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
346.90	54.5	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
347.00	62.8	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
347.10	71.5	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
347.20	80.4	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
347.30	86.5	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
347.40	87.4	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
347.50	88.3	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
347.60	89.2	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
347.70	90.1	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
347.80	90.9	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
347.90	91.8	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
348.00	92.6	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)



Subsection: Level Pool Pond Routing Summary

Label: SCM G (IN)

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	342.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	46.8 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	2.1 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	783.00 min

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Elevation (Water Surface, Peak)	344.92 ft
Volume (Peak)	1.366 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	2.178 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.261 ac-ft
Volume (Retained)	0.917 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM G (IN)

Return Event: 10 years

Storm Event: 10 yr

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#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	342.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	79.9 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	20.0 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	733.00 min

---

Elevation (Water Surface, Peak)	346.43 ft
Volume (Peak)	2.223 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.534 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.426 ac-ft
Volume (Retained)	1.106 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM G (IN)

Return Event: 25 years

Storm Event: 25 yr

---

#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	342.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	91.0 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	43.8 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	728.00 min

---

Elevation (Water Surface, Peak)	346.77 ft
Volume (Peak)	2.432 ac-ft

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---

#### Mass Balance (ac-ft)

---

Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	5.585 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	4.401 ac-ft
Volume (Retained)	1.181 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM G (IN)

Return Event: 100 years

Storm Event: 100 yr

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#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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---

#### Initial Conditions

---

Elevation (Water Surface, Initial)	342.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	106.9 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	74.3 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	725.00 min

---

Elevation (Water Surface, Peak)	347.13 ft
Volume (Peak)	2.662 ac-ft

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#### Mass Balance (ac-ft)

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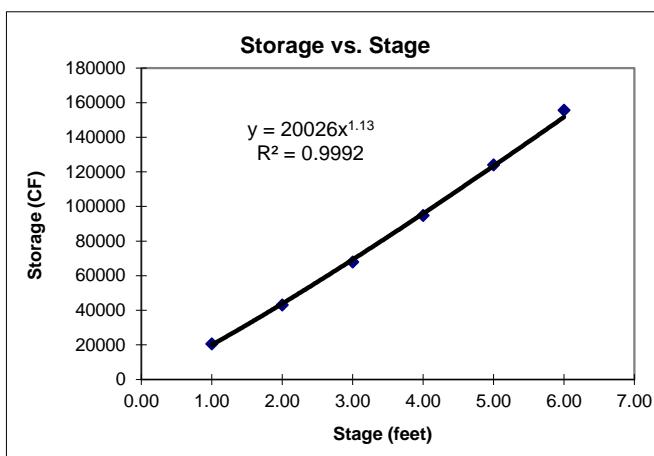
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	7.329 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	6.072 ac-ft
Volume (Retained)	1.255 ac-ft
Volume (Unrouted)	-0.003 ac-ft
Error (Mass Balance)	0.0 %

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*STORMWATER CONTROL MEASURE 'H'*  
*DESIGN CALCULATIONS*

**STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
334.00	0.00	19,424				
335.00	1.00	21,510	20467	20467	20467	1.02
336.00	2.00	23,648	22579	22579	43046	1.97
337.00	3.00	25,842	24745	24745	67791	2.94
338.00	4.00	28,094	26968	26968	94759	3.96
339.00	5.00	30,401	29248	29248	124007	5.02
340.00	6.00	32,765	31583	31583	155590	6.14



$K_s =$	20026
$b =$	1.1300

**WET DETENTION BASIN SUMMARY**

**Enter the drainage area characteristics ==>**

Total drainage area to pond = 16.12 acres  
Total impervious area to pond = 9.16 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **16.12** acres @ **56.8%** impervious

**Estimate the surface area required at pond normal pool elevation ==>**

Wet Detention Basins are based on an minimum average depth of = **3.01** feet (*Hard Coded*)

	3.0	3.01	4.0
Lower Boundary =>	50.0	1.79	1.51
Site % impervious =>	56.8	1.99	1.69
Upper Boundary =>	60.0	2.09	1.77

Therefore, SA/DA required = **1.99**

Surface area required for main pool at normal pool = 13,984 ft<sup>2</sup>  
= 0.32 acres

Surface area provided for total normal pool = 19,424 ft<sup>2</sup>

Surface area estimate for main pool at normal pool = 15,539 ft<sup>2</sup>

\*Assume main pool 80% of total normal pool area

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	16.12	acres
Impervious area =	9.16	acres
Percent impervious cover, I =	56.8	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.56 \\ WQ_V &= 0.75 \quad \text{acre-ft} \\ &= 32850 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 32850 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	20026
b =	1.130
$Z_o$ =	334.00
Volume in 1" rainfall =	32850 cf.

***Calculated values:***

Depth of WQv in Basin =	1.55	ft
=	18.60	inches
Elevation =	335.55	ft

**DRAWDOWN ORIFICE DESIGN**

D orifice =	2.75 inch
# orifices =	1
Ks =	20026
b =	1.1300
C <sub>d</sub> orifice =	0.60
Normal Pool Elevation =	334.00 feet
Volume @ Normal Pool =	0 cf
Orifice Invert =	334.00 feet
WSEL @ 1" Runoff Volume =	335.55 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
335.55	32850	0.238			
335.41	29641	0.226	0.232	3209	13845
335.28	26471	0.214	0.220	3170	14403
335.15	23344	0.201	0.208	3127	15055
335.01	20265	0.188	0.195	3079	15831
334.88	17239	0.173	0.180	3026	16780
334.74	14273	0.157	0.165	2966	17979
334.61	11376	0.139	0.148	2896	19572
334.47	8563	0.118	0.129	2813	21851
334.34	5854	0.093	0.106	2709	25570
334.20	3285	0.056	0.075	2569	34440

Drawdown Time =	2.26 days
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By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.478 feet
Orifice composite loss coefficient =	0.600
Cross-sectional area of siphon =	0.041 sf
Q =	0.1374 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time =	2.77 days
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Subsection: Elevation-Area Volume Curve

Label: SCM H

Return Event: 1 years  
Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
334.00	0.0	0.45	0.00	0.000	0.000
335.00	0.0	0.49	1.41	0.470	0.470
336.00	0.0	0.54	1.55	0.518	0.988
337.00	0.0	0.59	1.70	0.568	1.556
338.00	0.0	0.64	1.86	0.619	2.175
339.00	0.0	0.70	2.01	0.671	2.846
340.00	0.0	0.75	2.17	0.725	3.571



Subsection: Outlet Input Data

Label: SCMH

Return Event: 1 years  
Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	334.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	340.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Orifice-Circular	Orifice - 2	Forward	Culvert	335.70	340.00
Inlet Box	Riser	Forward	Culvert	338.00	340.00
Orifice-Circular	WQOrifice	Forward	Culvert	334.00	340.00
Culvert-Circular	Culvert	Forward	TW	332.50	340.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert	
Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	36.00 in
Length	50.00 ft
Length (Computed Barrel)	50.00 ft
Slope (Computed)	0.010 ft/ft
<hr/>	
Outlet Control Data	
Manning's n	0.013
Ke	0.2
Kb	0.0
Kr	0.0
Convergence Tolerance	0.00 ft
<hr/>	
Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.1
T2 ratio (HW/D)	1.2
Slope Correction Factor	-0.5

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Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

T1 Elevation	335.77 ft	T1 Flow	42.9 ft <sup>3</sup> /s
T2 Elevation	336.08 ft	T2 Flow	49.0 ft <sup>3</sup> /s

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Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	338.00 ft
Orifice Area	25.0 ft <sup>2</sup>
Orifice Coefficient	0.6
Weir Length	20.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False
Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	334.00 ft
Orifice Diameter	2.75 in
Orifice Coefficient	0.6
Structure ID: Orifice - 2	
Structure Type: Orifice-Circular	
Number of Openings	3
Elevation	335.70 ft
Orifice Diameter	8.00 in
Orifice Coefficient	0.6
Structure ID: TW	
Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall
Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
334.00	0.0	(N/A)	0.00	(no Q: Orifice - 2,Riser,WQOrifice,Culvert)
334.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
334.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
334.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
334.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
334.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
334.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
334.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
334.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
334.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
335.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
335.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
335.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
335.30	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
335.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
335.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
335.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
335.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
335.80	0.3	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
335.90	0.6	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
336.00	1.0	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
336.10	1.4	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
336.20	2.0	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
336.30	2.7	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
336.40	3.4	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
336.50	3.7	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
336.60	4.1	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
336.70	4.4	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
336.80	4.7	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
336.90	5.0	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
337.00	5.3	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
337.10	5.5	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
337.20	5.8	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
337.30	6.0	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
337.40	6.2	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
337.50	6.5	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
337.60	6.7	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
337.70	6.9	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
337.80	7.1	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
337.90	7.3	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
338.00	7.5	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
338.10	9.5	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
338.20	13.2	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
338.30	17.8	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
338.40	23.3	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
338.50	29.5	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
338.60	36.3	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
338.70	43.7	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
338.80	51.3	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
338.90	58.9	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
339.00	66.6	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
339.10	74.5	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
339.20	82.0	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
339.30	86.5	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
339.40	87.4	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
339.50	88.3	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
339.60	89.2	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
339.70	90.1	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
339.80	90.9	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
339.90	91.8	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
340.00	92.6	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)



Subsection: Level Pool Pond Routing Summary

Label: SCM H (IN)

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	334.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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---

#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	49.2 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	4.0 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	756.00 min

---

Elevation (Water Surface, Peak)	336.56 ft
Volume (Peak)	1.300 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	2.273 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.345 ac-ft
Volume (Retained)	0.927 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM H (IN)

Return Event: 10 years

Storm Event: 10 yr

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#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	334.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	89.7 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	20.9 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	751.00 min

---

Elevation (Water Surface, Peak)	338.36 ft
Volume (Peak)	2.407 ac-ft

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---

#### Mass Balance (ac-ft)

---

Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.999 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.994 ac-ft
Volume (Retained)	1.003 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM H (IN)

Return Event: 25 years

Storm Event: 25 yr

---

#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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---

#### Initial Conditions

---

Elevation (Water Surface, Initial)	334.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	103.6 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	42.9 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	729.00 min

---

Elevation (Water Surface, Peak)	338.69 ft
Volume (Peak)	2.631 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	6.233 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	5.212 ac-ft
Volume (Retained)	1.019 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM H (IN)

Return Event: 100 years

Storm Event: 100 yr

---

#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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---

#### Initial Conditions

---

Elevation (Water Surface, Initial)	334.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	123.4 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	76.7 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	726.00 min

---

Elevation (Water Surface, Peak)	339.13 ft
Volume (Peak)	2.937 ac-ft

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#### Mass Balance (ac-ft)

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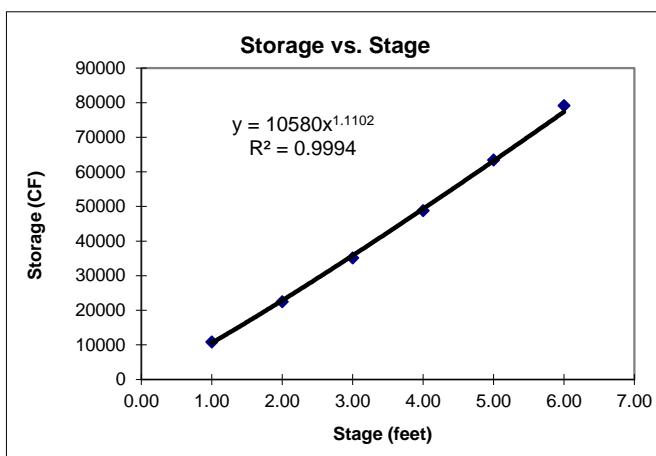
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	8.292 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	7.265 ac-ft
Volume (Retained)	1.024 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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*STORMWATER CONTROL MEASURE 'I'*  
*DESIGN CALCULATIONS*

**STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
318.00	0.00	10,342				
319.00	1.00	11,231	10787	10787	10787	1.02
320.00	2.00	12,159	11695	11695	22482	1.97
321.00	3.00	13,135	12647	12647	35129	2.95
322.00	4.00	14,139	13637	13637	48766	3.96
323.00	5.00	15,179	14659	14659	63425	5.02
324.00	6.00	16,255	15717	15717	79142	6.13



$K_s =$	10580
$b =$	1.1102

**WET DETENTION BASIN SUMMARY**

**Enter the drainage area characteristics ==>**

Total drainage area to pond = 9.24 acres  
Total impervious area to pond = 5.03 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **9.24** acres @ **54.4%** impervious

**Estimate the surface area required at pond normal pool elevation ==>**

Wet Detention Basins are based on an minimum average depth of = **3.01** feet (*Hard Coded*)

	3.0	3.01	4.0
Lower Boundary =>	50.0	1.79	1.51
Site % impervious =>	54.4	1.92	1.63
Upper Boundary =>	60.0	2.09	1.77

Therefore, SA/DA required = **1.92**

Surface area required for main pool at normal pool = 7,726 ft<sup>2</sup>  
= 0.18 acres

Surface area provided for total normal pool = 10,342 ft<sup>2</sup>

Surface area estimate for main pool at normal pool = 8,274 ft<sup>2</sup>

\*Assume main pool 80% of total normal pool area

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	9.24	acres
Impervious area =	5.03	acres
Percent impervious cover, I =	54.4	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.54 \\ WQ_V &= 0.42 \quad \text{acre-ft} \\ &= 18105 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 18105 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	10580
b =	1.110
$Z_o$ =	318.00
Volume in 1" rainfall =	18105 cf.

***Calculated values:***

$$\begin{aligned} \text{Depth of } WQ_V \text{ in Basin} &= 1.62 \quad \text{ft} \\ &= 19.47 \quad \text{inches} \\ \text{Elevation} &= 319.62 \quad \text{ft} \end{aligned}$$

**DRAWDOWN ORIFICE DESIGN**

D orifice =	2 inch
# orifices =	1
Ks =	10580
b =	1.1102
C <sub>d</sub> orifice =	0.60
Normal Pool Elevation =	318.00 feet
Volume @ Normal Pool =	0 cf
Orifice Invert =	318.00 feet
WSEL @ 1" Runoff Volume =	319.62 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
319.62	18105	0.130			
319.48	16356	0.124	0.127	1749	13765
319.34	14626	0.118	0.121	1730	14331
319.20	12916	0.111	0.114	1710	14990
319.06	11228	0.103	0.107	1688	15771
318.91	9565	0.096	0.099	1663	16721
318.77	7930	0.087	0.091	1635	17912
318.63	6328	0.078	0.082	1602	19474
318.49	4766	0.067	0.072	1562	21667
318.35	3254	0.054	0.060	1512	25116
318.20	1811	0.036	0.045	1443	32024

Drawdown Time = 2.22 days

By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.513 feet
Orifice composite loss coefficient =	0.600
Cross-sectional area of siphon =	0.022 sf
Q =	0.0752 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time = 2.79 days



Subsection: Elevation-Area Volume Curve

Label: SCM I

Return Event: 1 years  
Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
318.00	0.0	0.24	0.00	0.000	0.000
319.00	0.0	0.26	0.74	0.248	0.248
320.00	0.0	0.28	0.81	0.268	0.516
321.00	0.0	0.30	0.87	0.290	0.806
322.00	0.0	0.32	0.94	0.313	1.119
323.00	0.0	0.35	1.01	0.336	1.456
324.00	0.0	0.37	1.08	0.361	1.816



Subsection: Outlet Input Data

Label: SCMI

Return Event: 1 years  
Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	318.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	324.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Orifice-Circular	Orifice - 2	Forward	Culvert	319.80	324.00
Inlet Box	Riser	Forward	Culvert	321.50	324.00
Orifice-Circular	WQOrifice	Forward	Culvert	318.00	324.00
Culvert-Circular	Culvert	Forward	TW	316.50	324.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert	
Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	24.00 in
Length	50.00 ft
Length (Computed Barrel)	50.00 ft
Slope (Computed)	0.010 ft/ft
<hr/>	
Outlet Control Data	
Manning's n	0.013
Ke	0.2
Kb	0.0
Kr	0.0
Convergence Tolerance	0.00 ft
<hr/>	
Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.1
T2 ratio (HW/D)	1.2
Slope Correction Factor	-0.5

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Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

T1 Elevation	318.68 ft	T1 Flow	15.6 ft <sup>3</sup> /s
T2 Elevation	318.88 ft	T2 Flow	17.8 ft <sup>3</sup> /s

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Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	321.50 ft
Orifice Area	16.0 ft <sup>2</sup>
Orifice Coefficient	0.6
Weir Length	16.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False
Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	318.00 ft
Orifice Diameter	2.00 in
Orifice Coefficient	0.6
Structure ID: Orifice - 2	
Structure Type: Orifice-Circular	
Number of Openings	3
Elevation	319.80 ft
Orifice Diameter	6.00 in
Orifice Coefficient	0.6
Structure ID: TW	
Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall
Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
318.00	0.0	(N/A)	0.00	(no Q: Orifice - 2,Riser,WQOrifice,Culvert)
318.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
318.20	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
318.30	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
318.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
318.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
318.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
318.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
318.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
318.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
319.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
319.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
319.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
319.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
319.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
319.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
319.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
319.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
319.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
319.90	0.2	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
320.00	0.4	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
320.10	0.7	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
320.20	1.1	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
320.30	1.6	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
320.40	1.8	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
320.50	2.1	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
320.60	2.3	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
320.70	2.5	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
320.80	2.6	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
320.90	2.8	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
321.00	2.9	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
321.10	3.1	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
321.20	3.2	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
321.30	3.4	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
321.40	3.5	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
321.50	3.6	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
321.60	5.2	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
321.70	8.1	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
321.80	11.8	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
321.90	16.2	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
322.00	21.1	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
322.10	26.4	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
322.20	31.3	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
322.30	35.9	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
322.40	37.6	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
322.50	38.0	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
322.60	38.4	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
322.70	38.8	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
322.80	39.2	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
322.90	39.6	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
323.00	40.0	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
323.10	40.4	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
323.20	40.7	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
323.30	41.1	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
323.40	41.5	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
323.50	41.9	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
323.60	42.2	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
323.70	42.6	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
323.80	43.0	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
323.90	43.3	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
324.00	43.7	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)



Subsection: Level Pool Pond Routing Summary

Label: SCM I (IN)

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	318.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	25.6 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	2.1 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	757.00 min

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Elevation (Water Surface, Peak)	320.52 ft
Volume (Peak)	0.663 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.187 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.686 ac-ft
Volume (Retained)	0.500 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM I (IN)

Return Event: 10 years

Storm Event: 10 yr

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#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	318.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	49.0 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	21.1 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	729.00 min

---

Elevation (Water Surface, Peak)	322.00 ft
Volume (Peak)	1.119 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	2.709 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.174 ac-ft
Volume (Retained)	0.534 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM I (IN)

Return Event: 25 years

Storm Event: 25 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	318.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	57.1 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	35.8 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	726.00 min

---

Elevation (Water Surface, Peak)	322.30 ft
Volume (Peak)	1.217 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.406 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.863 ac-ft
Volume (Retained)	0.542 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM I (IN)

Return Event: 100 years

Storm Event: 100 yr

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#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	318.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	68.8 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	39.4 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	727.00 min

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Elevation (Water Surface, Peak)	322.85 ft
Volume (Peak)	1.405 ac-ft

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#### Mass Balance (ac-ft)

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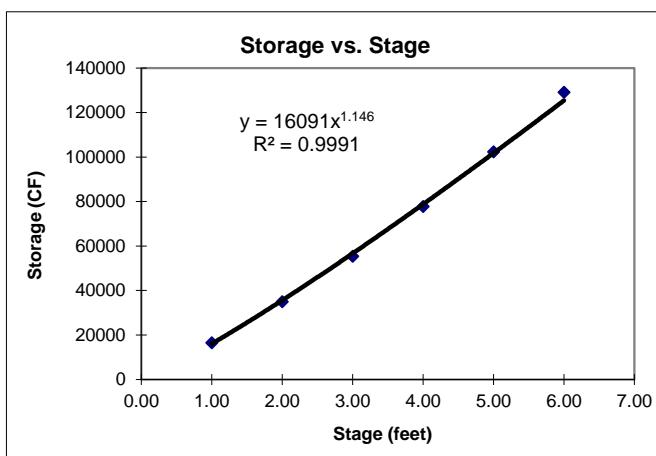
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.573 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	4.028 ac-ft
Volume (Retained)	0.544 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---

*STORMWATER CONTROL MEASURE 'J'*  
*DESIGN CALCULATIONS*

**STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
310.00	0.00	15,533				
311.00	1.00	17,438	16486	16486	16486	1.02
312.00	2.00	19,397	18418	18418	34903	1.97
313.00	3.00	21,413	20405	20405	55308	2.94
314.00	4.00	23,485	22449	22449	77757	3.95
315.00	5.00	25,614	24550	24550	102307	5.02
316.00	6.00	27,799	26707	26707	129013	6.15



$K_s =$	16091
$b =$	1.1460

**WET DETENTION BASIN SUMMARY**

**Enter the drainage area characteristics ==>**

Total drainage area to pond = 11.68 acres  
Total impervious area to pond = 6.72 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **11.68** acres @ **57.5%** impervious

**Estimate the surface area required at pond normal pool elevation ==>**

Wet Detention Basins are based on an minimum average depth of = **3.01** feet (*Hard Coded*)

	3.0	3.01	4.0
Lower Boundary =>	50.0	1.79	1.51
Site % impervious =>	57.5	2.02	2.01
Upper Boundary =>	60.0	2.09	1.77

Therefore, SA/DA required = **2.01**

Surface area required for main pool at normal pool = 10,239 ft<sup>2</sup>  
= 0.24 acres

Surface area provided for total normal pool = 15,533 ft<sup>2</sup>

Surface area estimate for main pool at normal pool = 12,426 ft<sup>2</sup>

\*Assume main pool 80% of total normal pool area

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	11.68	acres
Impervious area =	6.72	acres
Percent impervious cover, I =	57.5	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.57 \\ WQ_V &= 0.55 \quad \text{acre-ft} \\ &= 24069 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 24069 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	16091
b =	1.146
$Z_o$ =	310.00
Volume in 1" rainfall =	24069 cf.

***Calculated values:***

Depth of WQv in Basin =	1.42	ft
=	17.05	inches
Elevation =	311.42	ft

**DRAWDOWN ORIFICE DESIGN**

D orifice =	2.25 inch
# orifices =	1
Ks =	16091
b =	1.1460
C <sub>d</sub> orifice =	0.60
Normal Pool Elevation =	310.00 feet
Volume @ Normal Pool =	0 cf
Orifice Invert =	310.00 feet
WSEL @ 1" Runoff Volume =	311.42 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
311.42	24069	0.153			
311.30	21696	0.146	0.149	2373	15895
311.17	19356	0.138	0.142	2340	16500
311.05	17051	0.130	0.134	2305	17203
310.93	14786	0.121	0.126	2266	18036
310.81	12564	0.112	0.117	2222	19049
310.68	10391	0.102	0.107	2173	20320
310.56	8274	0.091	0.096	2116	21990
310.44	6225	0.078	0.084	2049	24343
310.31	4260	0.062	0.070	1965	28083
310.19	2407	0.041	0.052	1853	35799

Drawdown Time = 2.51 days

By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.442 feet
Orifice composite loss coefficient =	0.600
Cross-sectional area of siphon =	0.028 sf
Q =	0.0884 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time = 3.15 days



Subsection: Elevation-Area Volume Curve

Label: SCM J

Return Event: 1 years  
Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
310.00	0.0	0.36	0.00	0.000	0.000
311.00	0.0	0.40	1.13	0.378	0.378
312.00	0.0	0.45	1.27	0.423	0.801
313.00	0.0	0.49	1.40	0.468	1.269
314.00	0.0	0.54	1.55	0.515	1.784
315.00	0.0	0.59	1.69	0.563	2.348
316.00	0.0	0.64	1.84	0.613	2.961



Subsection: Outlet Input Data

Label: SCMJ

Return Event: 1 years  
Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	310.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	316.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Orifice-Circular	Orifice - 2	Forward	Culvert	311.70	316.00
Inlet Box	Riser	Forward	Culvert	314.30	316.00
Orifice-Circular	WQOrifice	Forward	Culvert	310.00	316.00
Culvert-Circular	Culvert	Forward	TW	308.50	316.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert	
Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	36.00 in
Length	50.00 ft
Length (Computed Barrel)	50.00 ft
Slope (Computed)	0.010 ft/ft
<hr/>	
Outlet Control Data	
Manning's n	0.013
Ke	0.2
Kb	0.0
Kr	0.0
Convergence Tolerance	0.00 ft
<hr/>	
Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.1
T2 ratio (HW/D)	1.2
Slope Correction Factor	-0.5

---

Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

T1 Elevation	311.77 ft	T1 Flow	42.9 ft <sup>3</sup> /s
T2 Elevation	312.08 ft	T2 Flow	49.0 ft <sup>3</sup> /s

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Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	314.30 ft
Orifice Area	25.0 ft <sup>2</sup>
Orifice Coefficient	0.6
Weir Length	20.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False
Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	310.00 ft
Orifice Diameter	2.25 in
Orifice Coefficient	0.6
Structure ID: Orifice - 2	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	311.70 ft
Orifice Diameter	6.00 in
Orifice Coefficient	0.6
Structure ID: TW	
Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall
Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
310.00	0.0	(N/A)	0.00	(no Q: Orifice - 2,Riser,WQOrifice,Culvert)
310.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
310.20	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
310.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
310.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
310.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
310.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
310.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
310.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
310.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
311.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
311.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
311.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
311.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
311.40	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
311.50	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
311.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
311.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
311.80	0.2	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
311.90	0.3	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
312.00	0.4	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
312.10	0.5	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
312.20	0.7	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
312.30	0.8	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
312.40	0.8	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
312.50	0.9	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
312.60	1.0	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
312.70	1.0	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
312.80	1.1	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
312.90	1.1	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
313.00	1.2	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
313.10	1.2	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
313.20	1.3	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
313.30	1.3	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
313.40	1.4	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
313.50	1.4	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
313.60	1.5	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
313.70	1.5	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
313.80	1.5	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
313.90	1.6	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
314.00	1.6	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
314.10	1.7	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
314.20	1.7	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
314.30	1.7	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
314.40	3.7	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
314.50	7.2	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
314.60	11.7	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
314.70	17.0	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
314.80	23.1	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
314.90	29.8	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
315.00	37.0	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
315.10	44.8	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
315.20	53.0	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
315.30	61.6	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
315.40	70.6	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
315.50	79.9	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
315.60	89.0	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
315.70	90.1	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
315.80	90.9	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
315.90	91.8	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
316.00	92.6	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)



Subsection: Level Pool Pond Routing Summary

Label: SCM J (IN)

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	34.0 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	0.9 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	903.00 min

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Elevation (Water Surface, Peak)	312.51 ft
Volume (Peak)	1.033 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.572 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.731 ac-ft
Volume (Retained)	0.840 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM J (IN)

Return Event: 10 years

Storm Event: 10 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	63.5 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	9.4 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	754.00 min

---

Elevation (Water Surface, Peak)	314.55 ft
Volume (Peak)	2.088 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.523 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.041 ac-ft
Volume (Retained)	1.479 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.1 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM J (IN)

Return Event: 25 years

Storm Event: 25 yr

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#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	73.6 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	18.5 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	751.00 min

---

Elevation (Water Surface, Peak)	314.72 ft
Volume (Peak)	2.188 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.410 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.828 ac-ft
Volume (Retained)	1.580 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM J (IN)

Return Event: 100 years

Storm Event: 100 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	88.2 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	47.4 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	727.00 min

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Elevation (Water Surface, Peak)	315.13 ft
Volume (Peak)	2.425 ac-ft

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#### Mass Balance (ac-ft)

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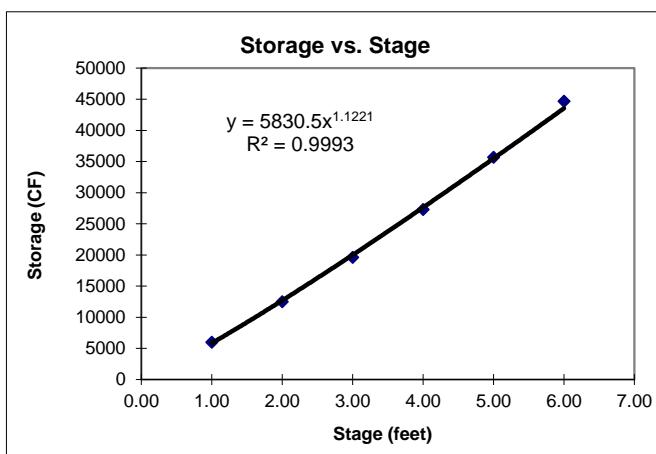
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	5.894 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	4.276 ac-ft
Volume (Retained)	1.616 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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*STORMWATER CONTROL MEASURE 'K'*  
*DESIGN CALCULATIONS*

**STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
310.00	0.00	5,679				
311.00	1.00	6,231	5955	5955	5955	1.02
312.00	2.00	6,806	6519	6519	12474	1.97
313.00	3.00	7,404	7105	7105	19579	2.94
314.00	4.00	8,025	7715	7715	27293	3.96
315.00	5.00	8,670	8348	8348	35641	5.02
316.00	6.00	9,337	9004	9004	44644	6.14



$K_s = 5830$ $b = 1.1221$
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**WET DETENTION BASIN SUMMARY**

**Enter the drainage area characteristics ==>**

Total drainage area to pond = 5.25 acres  
Total impervious area to pond = 2.26 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **5.25** acres @ **43.0%** impervious

**Estimate the surface area required at pond normal pool elevation ==>**

Wet Detention Basins are based on an minimum average depth of = **3.01** feet (*Hard Coded*)

	3.0	3.01	4.0
Lower Boundary =>	40.0	1.51	1.24
Site % impervious =>	43.0	1.59	1.32
Upper Boundary =>	50.0	1.79	1.51

Therefore, SA/DA required = **1.59**

Surface area required for main pool at normal pool = 3,640 ft<sup>2</sup>  
= 0.08 acres

Surface area provided for total normal pool = 5,679 ft<sup>2</sup>

Surface area estimate for main pool at normal pool = 4,543 ft<sup>2</sup>

\*Assume main pool 80% of total normal pool area

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	5.25	acres
Impervious area =	2.26	acres
Percent impervious cover, I =	43.0	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.44 \\ WQ_V &= 0.19 \quad \text{acre-ft} \\ &= 8329 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 8329 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	5830
b =	1.122
$Z_o$ =	310.00
Volume in 1" rainfall =	8329 cf.

***Calculated values:***

Depth of WQv in Basin =	1.37	ft
=	16.49	inches
Elevation =	311.37	ft

**DRAWDOWN ORIFICE DESIGN**

D orifice = **1.25** inch  
 # orifices = **1**  
 Ks = 5830  
 b = 1.1221  
 Cd orifice = **0.60**  
 Normal Pool Elevation = 310.00 feet  
 Volume @ Normal Pool = 0 cf  
 Orifice Invert = 310.00 feet  
 WSEL @ 1" Runoff Volume = 311.37 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
311.37	8329	0.047			
311.25	7519	0.045	0.046	810	17605
311.13	6719	0.043	0.044	801	18292
311.01	5928	0.040	0.041	790	19087
310.90	5149	0.038	0.039	779	20024
310.78	4383	0.035	0.036	766	21155
310.66	3631	0.032	0.033	752	22561
310.54	2895	0.028	0.030	735	24382
310.42	2180	0.025	0.027	715	26890
310.30	1489	0.020	0.022	690	30710
310.18	833	0.014	0.017	656	37826

Drawdown Time = 2.76 days

By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice = 0.441 feet  
 Orifice composite loss coefficient = **0.600**  
 Cross-sectional area of siphon = 0.009 sf  
 Q = 0.0272 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time = 3.54 days



Subsection: Elevation-Area Volume Curve

Label: SCM K

Return Event: 1 years  
Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
310.00	0.0	0.13	0.00	0.000	0.000
311.00	0.0	0.14	0.41	0.137	0.137
312.00	0.0	0.16	0.45	0.150	0.286
313.00	0.0	0.17	0.49	0.163	0.449
314.00	0.0	0.18	0.53	0.177	0.626
315.00	0.0	0.20	0.57	0.192	0.818
316.00	0.0	0.21	0.62	0.207	1.025



Subsection: Outlet Input Data

Label: SCMK

Return Event: 1 years

Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	310.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	316.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	Riser	Forward	Culvert	314.00	316.00
Orifice-Circular	WQOrifice	Forward	Culvert	310.00	316.00
Culvert-Circular	Culvert	Forward	TW	308.50	316.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert		
Structure Type: Culvert-Circular		
Number of Barrels	1	
Diameter	24.00 in	
Length	50.00 ft	
Length (Computed Barrel)	50.00 ft	
Slope (Computed)	0.010 ft/ft	
<hr/>		
Outlet Control Data		
Manning's n	0.013	
Ke	0.2	
Kb	0.0	
Kr	0.0	
Convergence Tolerance	0.00 ft	
<hr/>		
Inlet Control Data		
Equation Form	Form 1	
K	0.0045	
M	2.0000	
C	0.0317	
Y	0.6900	
T1 ratio (HW/D)	1.1	
T2 ratio (HW/D)	1.2	
Slope Correction Factor	-0.5	

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Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

T1 Elevation	310.68 ft	T1 Flow	15.6 ft <sup>3</sup> /s
T2 Elevation	310.88 ft	T2 Flow	17.8 ft <sup>3</sup> /s

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Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	314.00 ft
Orifice Area	16.0 ft <sup>2</sup>
Orifice Coefficient	0.6
Weir Length	16.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False
Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	310.00 ft
Orifice Diameter	1.25 in
Orifice Coefficient	0.6
Structure ID: TW	
Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall
Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
310.00	0.0	(N/A)	0.00	(no Q: Riser,WQOrifice,Culvert)
310.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
310.20	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
310.30	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
310.40	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
310.50	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
310.60	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
310.70	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
310.80	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
310.90	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
311.00	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
311.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
311.20	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
311.30	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
311.40	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
311.50	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
311.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
311.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
311.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
311.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
312.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
312.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
312.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
312.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
312.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
312.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
312.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
312.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
312.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
312.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
313.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
313.10	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
313.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
313.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
313.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
313.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
313.60	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
313.70	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
313.80	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
313.90	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
314.00	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
314.10	1.6	(N/A)	0.00	Riser,WQOrifice,Culvert
314.20	4.4	(N/A)	0.00	Riser,WQOrifice,Culvert
314.30	8.0	(N/A)	0.00	Riser,WQOrifice,Culvert
314.40	12.2	(N/A)	0.00	Riser,WQOrifice,Culvert
314.50	17.0	(N/A)	0.00	Riser,WQOrifice,Culvert
314.60	22.4	(N/A)	0.00	Riser,WQOrifice,Culvert
314.70	28.2	(N/A)	0.00	Riser,WQOrifice,Culvert
314.80	34.4	(N/A)	0.00	Riser,WQOrifice,Culvert
314.90	39.6	(N/A)	0.00	Riser,WQOrifice,Culvert
315.00	40.0	(N/A)	0.00	Riser,WQOrifice,Culvert
315.10	40.4	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
315.20	40.7	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
315.30	41.1	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
315.40	41.5	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
315.50	41.9	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
315.60	42.2	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)



Subsection: Composite Rating Curve

Label: SCMK

Return Event: 1 years

Storm Event: 1 yr

#### Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
315.70	42.6	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
315.80	43.0	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
315.90	43.3	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
316.00	43.7	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)



Subsection: Level Pool Pond Routing Summary

Label: SCM K (IN)

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	15.3 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	0.1 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	1,440.00 min

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Elevation (Water Surface, Peak)	314.00 ft
Volume (Peak)	0.627 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.707 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.080 ac-ft
Volume (Retained)	0.627 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM K (IN)

Return Event: 10 years

Storm Event: 10 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	28.5 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	12.3 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	729.00 min

---

Elevation (Water Surface, Peak)	314.40 ft
Volume (Peak)	0.702 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.583 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.954 ac-ft
Volume (Retained)	0.629 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM K (IN)

Return Event: 25 years

Storm Event: 25 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	33.1 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	23.9 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	725.00 min

---

Elevation (Water Surface, Peak)	314.63 ft
Volume (Peak)	0.745 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.982 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.352 ac-ft
Volume (Retained)	0.630 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---



Subsection: Level Pool Pond Routing Summary

Label: SCM K (IN)

Return Event: 100 years

Storm Event: 100 yr

---

#### Infiltration

---

Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

---

Elevation (Water Surface, Initial)	310.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	39.7 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	35.2 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	723.00 min

---

Elevation (Water Surface, Peak)	314.82 ft
Volume (Peak)	0.782 ac-ft

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#### Mass Balance (ac-ft)

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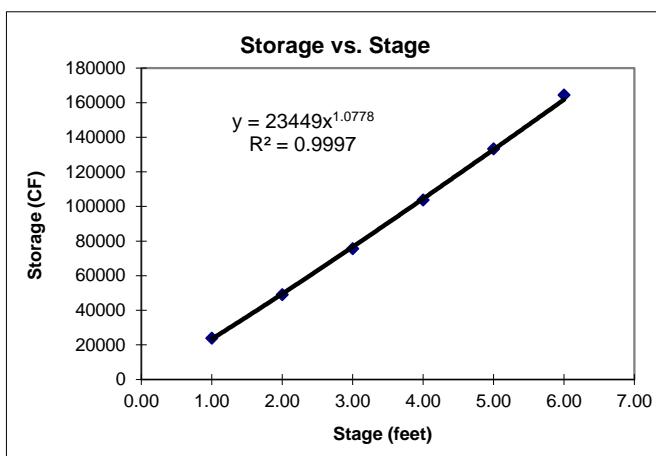
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	2.649 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.019 ac-ft
Volume (Retained)	0.630 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

---

*STORMWATER CONTROL MEASURE 'L'*  
*DESIGN CALCULATIONS*

**STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
300.00	0.00	23,079				
301.00	1.00	24,466	23773	23773	23773	1.01
302.00	2.00	25,888	25177	25177	48950	1.98
303.00	3.00	27,347	26618	26618	75567	2.96
304.00	4.00	28,840	28094	28094	103661	3.97
305.00	5.00	30,369	29605	29605	133265	5.01
306.00	6.00	31,934	31152	31152	164417	6.09



$K_s =$ $b =$	23449 1.0778
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**WET DETENTION BASIN SUMMARY**

**Enter the drainage area characteristics ==>**

Total drainage area to pond = 15.25 acres  
Total impervious area to pond = 8.63 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **15.25** acres @ **56.6%** impervious

**Estimate the surface area required at pond normal pool elevation ==>**

Wet Detention Basins are based on an minimum average depth of = **3.01** feet (*Hard Coded*)

	3.0	3.01	4.0
Lower Boundary =>	50.0	1.79	1.51
Site % impervious =>	56.6	1.99	1.68
Upper Boundary =>	60.0	2.09	1.77

Therefore, SA/DA required = **1.99**

Surface area required for main pool at normal pool = 13,189 ft<sup>2</sup>  
= 0.30 acres

Surface area provided for total normal pool = 23,079 ft<sup>2</sup>

Surface area estimate for main pool at normal pool = 18,463 ft<sup>2</sup>

\*Assume main pool 80% of total normal pool area

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	15.25	acres
Impervious area =	8.63	acres
Percent impervious cover, I =	56.6	%
Rainfall, P =	1.00	inches

***Calculated values:***

$R_V =$	0.56	
$WQ_V =$	0.71	acre-ft
=	30976	cf.

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 30976 \text{ cf.}$$

***Stage / Storage Data:***

$K_s =$	23449	
$b =$	1.078	
$Z_o =$	300.00	
Volume in 1" rainfall =	30976	cf.

***Calculated values:***

Depth of WQv in Basin =	1.29	ft
=	15.54	inches
Elevation =	301.29	ft

**DRAWDOWN ORIFICE DESIGN**

D orifice =	3 inch
# orifices =	1
Ks =	23449
b =	1.0778
C <sub>d</sub> orifice =	0.60
Normal Pool Elevation =	300.00 feet
Volume @ Normal Pool =	0 cf
Orifice Invert =	300.00 feet
WSEL @ 1" Runoff Volume =	301.29 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
301.29	30976	0.255			
301.18	28042	0.242	0.249	2934	11791
301.07	25130	0.229	0.236	2912	12355
300.95	22242	0.215	0.222	2888	13020
300.84	19381	0.199	0.207	2861	13825
300.72	16551	0.183	0.191	2831	14825
300.61	13755	0.164	0.173	2796	16120
300.50	10999	0.144	0.154	2755	17897
300.38	8294	0.119	0.132	2706	20571
300.27	5651	0.089	0.104	2643	25361
300.15	3098	0.040	0.064	2553	39597

Drawdown Time =	2.15 days
-----------------	-----------

By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.390 feet
Orifice composite loss coefficient =	0.600
Cross-sectional area of siphon =	0.049 sf
Q =	0.1476 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time =	2.43 days
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Subsection: Elevation-Area Volume Curve

Label: SCM L

Return Event: 1 years

Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
300.00	0.0	0.53	0.00	0.000	0.000
301.00	0.0	0.56	1.64	0.546	0.546
302.00	0.0	0.59	1.73	0.578	1.124
303.00	0.0	0.63	1.83	0.611	1.735
304.00	0.0	0.66	1.93	0.645	2.379
305.00	0.0	0.70	2.04	0.680	3.059
306.00	0.0	0.73	2.15	0.715	3.774



Subsection: Outlet Input Data

Label: SCML

Return Event: 1 years  
Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	300.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	306.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Orifice-Circular	Orifice - 2	Forward	Culvert	301.50	306.00
Inlet Box	Riser	Forward	Culvert	303.50	306.00
Orifice-Circular	WQOrifice	Forward	Culvert	300.00	306.00
Culvert-Circular	Culvert	Forward	TW	298.50	306.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert	
Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	36.00 in
Length	50.00 ft
Length (Computed Barrel)	50.00 ft
Slope (Computed)	0.010 ft/ft
<hr/>	
Outlet Control Data	
Manning's n	0.013
Ke	0.2
Kb	0.0
Kr	0.0
Convergence Tolerance	0.00 ft
<hr/>	
Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.1
T2 ratio (HW/D)	1.2
Slope Correction Factor	-0.5

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Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

T1 Elevation	301.77 ft	T1 Flow	42.9 ft <sup>3</sup> /s
T2 Elevation	302.08 ft	T2 Flow	49.0 ft <sup>3</sup> /s

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Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	303.50 ft
Orifice Area	25.0 ft <sup>2</sup>
Orifice Coefficient	0.6
Weir Length	20.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False
Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	300.00 ft
Orifice Diameter	3.00 in
Orifice Coefficient	0.6
Structure ID: Orifice - 2	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	301.50 ft
Orifice Diameter	6.00 in
Orifice Coefficient	0.6
Structure ID: TW	
Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall
Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
300.00	0.0	(N/A)	0.00	(no Q: Orifice - 2,Riser,WQOrifice,Culvert)
300.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
300.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
300.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
300.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
300.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
300.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
300.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
300.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
300.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
301.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
301.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
301.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
301.30	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
301.40	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
301.50	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Orifice - 2,Riser)
301.60	0.3	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
301.70	0.4	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
301.80	0.5	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
301.90	0.6	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
302.00	0.8	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
302.10	0.9	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
302.20	1.0	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
302.30	1.0	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
302.40	1.1	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
302.50	1.2	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
302.60	1.2	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
302.70	1.3	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
302.80	1.4	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
302.90	1.4	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
303.00	1.5	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
303.10	1.5	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
303.20	1.6	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
303.30	1.6	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
303.40	1.6	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
303.50	1.7	(N/A)	0.00	Orifice - 2,WQOrifice,Culvert (no Q: Riser)
303.60	3.6	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
303.70	7.1	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
303.80	11.7	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
303.90	17.0	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
304.00	23.0	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
304.10	29.7	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
304.20	37.0	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
304.30	44.7	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
304.40	52.9	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
304.50	61.4	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
304.60	70.3	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
304.70	79.3	(N/A)	0.00	Orifice - 2,Riser,WQOrifice,Culvert
304.80	81.8	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
304.90	82.8	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
305.00	83.7	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
305.10	84.6	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
305.20	85.6	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
305.30	86.5	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
305.40	87.4	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
305.50	88.3	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
305.60	89.2	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
305.70	90.1	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
305.80	90.9	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
305.90	91.8	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)
306.00	92.6	(N/A)	0.00	Riser,Culvert (no Q: Orifice - 2,WQOrifice)



Subsection: Level Pool Pond Routing Summary

Label: SCM L (IN)

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	300.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	44.4 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	1.1 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	903.00 min

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Elevation (Water Surface, Peak)	302.40 ft
Volume (Peak)	1.361 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	2.053 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.954 ac-ft
Volume (Retained)	1.098 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.1 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM L (IN)

Return Event: 10 years

Storm Event: 10 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	300.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	82.9 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	19.1 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	751.00 min

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Elevation (Water Surface, Peak)	303.93 ft
Volume (Peak)	2.336 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.600 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.831 ac-ft
Volume (Retained)	1.767 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM L (IN)

Return Event: 25 years

Storm Event: 25 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	300.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	96.2 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	38.1 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	729.00 min

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Elevation (Water Surface, Peak)	304.21 ft
Volume (Peak)	2.522 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	5.758 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	3.917 ac-ft
Volume (Retained)	1.840 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM L (IN)

Return Event: 100 years

Storm Event: 100 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	300.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	115.2 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	75.5 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	726.00 min

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Elevation (Water Surface, Peak)	304.66 ft
Volume (Peak)	2.822 ac-ft

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#### Mass Balance (ac-ft)

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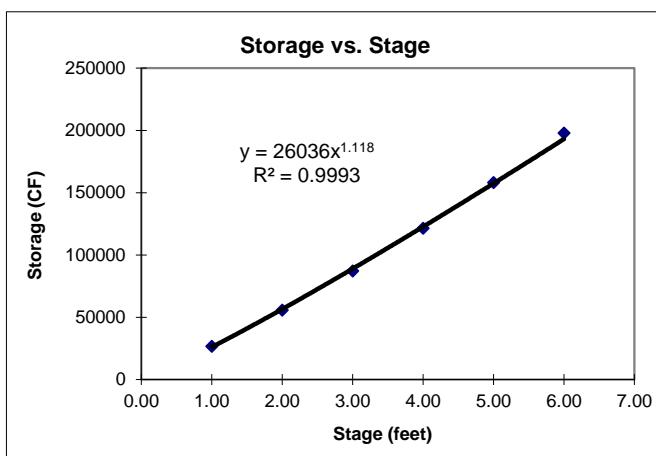
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	7.696 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	5.833 ac-ft
Volume (Retained)	1.861 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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*STORMWATER CONTROL MEASURE 'M'*  
*DESIGN CALCULATIONS*

**STAGE-STORAGE FUNCTION - ABOVE NORMAL POOL**

Contour (feet)	Stage (feet)	Contour Area (SF)	Average Contour Area (SF)	Incremental Contour Volume (CF)	Accumulated Contour Volume (CF)	Estimated Stage w/ S-S Fxn (feet)
340.00	0.00	25,355				
341.00	1.00	27,781	26568	26568	26568	1.02
342.00	2.00	30,263	29022	29022	55590	1.97
343.00	3.00	32,802	31533	31533	87123	2.95
344.00	4.00	35,397	34100	34100	121222	3.96
345.00	5.00	38,256	36827	36827	158049	5.02
346.00	6.00	41,174	39715	39715	197764	6.13



$K_s =$ $b =$	26036 1.1180
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**WET DETENTION BASIN SUMMARY**

*Enter the drainage area characteristics ==>*

Total drainage area to pond = 17.45 acres  
Total impervious area to pond = 7.45 acres

Note The basin must be sized to treat all impervious surface runoff draining into the pond, not just the impervious surface from on-site development.

Drainage area = **17.45** acres @ **42.7%** impervious

*Estimate the surface area required at pond normal pool elevation ==>*

Wet Detention Basins are based on an minimum average depth of = **3.01** feet (*Hard Coded*)

	3.0	3.01	4.0
Lower Boundary =>	40.0	1.51	1.24
Site % impervious =>	42.7	1.59	1.31
Upper Boundary =>	50.0	1.79	1.51

Therefore, SA/DA required = **1.58**

Surface area required for main pool at normal pool = 12,034 ft<sup>2</sup>  
= 0.28 acres

Surface area provided for total normal pool = 25,355 ft<sup>2</sup>

Surface area estimate for main pool at normal pool = 20,284 ft<sup>2</sup>

\*Assume main pool 80% of total normal pool area

**DETERMINATION OF WATER QUALITY VOLUME**

$$WQ_V = (P)(R_V)(A)/12$$

where,

$WQ_V$  = water quality volume (in acre-ft)

$R_V = 0.05 + 0.009(I)$  where I is percent impervious cover

A = area in acres

P = rainfall (in inches)

***Input data:***

Total area, A =	17.45	acres
Impervious area =	7.45	acres
Percent impervious cover, I =	42.7	%
Rainfall, P =	1.00	inches

***Calculated values:***

$$\begin{aligned} R_V &= 0.43 \\ WQ_V &= 0.63 \quad \text{acre-ft} \\ &= 27516 \quad \text{cf.} \end{aligned}$$

**ASSOCIATED DEPTH IN POND**

$$WQ_V = 27516 \quad \text{cf.}$$

***Stage / Storage Data:***

$K_s$ =	26036
b =	1.118
$Z_o$ =	340.00
Volume in 1" rainfall =	27516 cf.

***Calculated values:***

$$\begin{aligned} \text{Depth of } WQ_V \text{ in Basin} &= 1.05 \quad \text{ft} \\ &= 12.61 \quad \text{inches} \\ \text{Elevation} &= 341.05 \quad \text{ft} \end{aligned}$$

**DRAWDOWN ORIFICE DESIGN**

D orifice =	3 inch
# orifices =	1
Ks =	26036
b =	1.1180
C <sub>d</sub> orifice =	0.60
Normal Pool Elevation =	340.00 feet
Volume @ Normal Pool =	0 cf
Orifice Invert =	340.00 feet
WSEL @ 1" Runoff Volume =	341.05 feet

WSEL (feet)	Vol. Stored (cf)	Orifice Flow (cfs)	Avg. Flow (cfs)	Incr. Vol. (cf)	Incr. Time (sec)
341.05	27516	0.227			
340.96	24846	0.216	0.221	2670	12066
340.87	22206	0.203	0.209	2640	12606
340.78	19599	0.190	0.197	2607	13245
340.68	17028	0.176	0.183	2571	14019
340.59	14498	0.161	0.169	2530	14984
340.50	12013	0.145	0.153	2484	16241
340.41	9582	0.126	0.135	2431	17982
340.32	7215	0.103	0.115	2367	20651
340.23	4928	0.072	0.088	2287	26094
340.13	2752	0.033	0.052	2177	41615

Drawdown Time =	2.19 days
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By comparison, if calculated by the average head over the orifice  
(assuming average head is one-third the total depth), the result would be:

Average driving head on orifice =	0.309 feet
Orifice composite loss coefficient =	0.600
Cross-sectional area of siphon =	0.049 sf
Q =	0.1313 cfs

Drawdown Time = Volume / Flowrate / 86400 (sec/day)

Drawdown Time =	2.43 days
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Subsection: Elevation-Area Volume Curve

Label: SCM M

Return Event: 1 years

Storm Event: 1 yr

Elevation (ft)	Planimeter (ft <sup>2</sup> )	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
340.00	0.0	0.58	0.00	0.000	0.000
341.00	0.0	0.64	1.83	0.610	0.610
342.00	0.0	0.69	2.00	0.666	1.276
343.00	0.0	0.75	2.17	0.724	1.999
344.00	0.0	0.81	2.35	0.783	2.782
345.00	0.0	0.88	2.54	0.845	3.627
346.00	0.0	0.95	2.73	0.912	4.539



Subsection: Outlet Input Data

Label: SCMM

Return Event: 1 years  
Storm Event: 1 yr

#### Requested Pond Water Surface Elevations

Minimum (Headwater)	340.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	346.00 ft

#### Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	Riser	Forward	Culvert	344.00	346.00
Orifice-Circular	WQOrifice	Forward	Culvert	340.00	346.00
Culvert-Circular	Culvert	Forward	TW	338.50	346.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Culvert	
Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	36.00 in
Length	50.00 ft
Length (Computed Barrel)	50.00 ft
Slope (Computed)	0.010 ft/ft
<hr/>	
Outlet Control Data	
Manning's n	0.013
Ke	0.2
Kb	0.0
Kr	0.0
Convergence Tolerance	0.00 ft
<hr/>	
Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.1
T2 ratio (HW/D)	1.2
Slope Correction Factor	-0.5

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Use unsubmerged inlet control 0 equation below T1 elevation.

Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,  
interpolate between flows at T1 & T2...

T1 Elevation	341.77 ft	T1 Flow	42.9 ft <sup>3</sup> /s
T2 Elevation	342.08 ft	T2 Flow	49.0 ft <sup>3</sup> /s

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Subsection: Outlet Input Data

Label: SCMM

Return Event: 1 years  
Storm Event: 1 yr

Structure ID: Riser	
Structure Type: Inlet Box	
Number of Openings	1
Elevation	344.00 ft
Orifice Area	25.0 ft <sup>2</sup>
Orifice Coefficient	0.6
Weir Length	20.00 ft
Weir Coefficient	3.00 (ft <sup>0.5</sup> )/s
K Reverse	1.0
Manning's n	0.0
Kev, Charged Riser	0.0
Weir Submergence	False
Orifice H to crest	False
Structure ID: WQOrifice	
Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	340.00 ft
Orifice Diameter	3.00 in
Orifice Coefficient	0.6
Structure ID: TW	
Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall
Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.0 ft <sup>3</sup> /s
Flow Tolerance (Maximum)	10.0 ft <sup>3</sup> /s

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
340.00	0.0	(N/A)	0.00	(no Q: Riser,WQOrifice,Culvert)
340.10	0.0	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
340.20	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
340.30	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
340.40	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
340.50	0.1	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
340.60	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
340.70	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
340.80	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
340.90	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
341.00	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
341.10	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
341.20	0.2	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
341.30	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
341.40	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
341.50	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
341.60	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
341.70	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
341.80	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
341.90	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
342.00	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
342.10	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
342.20	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
342.30	0.3	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
342.40	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
342.50	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)

## Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
342.60	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
342.70	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
342.80	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
342.90	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
343.00	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
343.10	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
343.20	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
343.30	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
343.40	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
343.50	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
343.60	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
343.70	0.4	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
343.80	0.5	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
343.90	0.5	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
344.00	0.5	(N/A)	0.00	WQOrifice,Culvert (no Q: Riser)
344.10	2.4	(N/A)	0.00	Riser,WQOrifice,Culvert
344.20	5.8	(N/A)	0.00	Riser,WQOrifice,Culvert
344.30	10.3	(N/A)	0.00	Riser,WQOrifice,Culvert
344.40	15.6	(N/A)	0.00	Riser,WQOrifice,Culvert
344.50	21.7	(N/A)	0.00	Riser,WQOrifice,Culvert
344.60	28.3	(N/A)	0.00	Riser,WQOrifice,Culvert
344.70	35.6	(N/A)	0.00	Riser,WQOrifice,Culvert
344.80	43.3	(N/A)	0.00	Riser,WQOrifice,Culvert
344.90	51.6	(N/A)	0.00	Riser,WQOrifice,Culvert
345.00	60.3	(N/A)	0.00	Riser,WQOrifice,Culvert
345.10	69.5	(N/A)	0.00	Riser,WQOrifice,Culvert
345.20	79.0	(N/A)	0.00	Riser,WQOrifice,Culvert
345.30	86.5	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
345.40	87.4	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
345.50	88.3	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
345.60	89.2	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
345.70	90.1	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)



Subsection: Composite Rating Curve

Label: SCMM

Return Event: 1 years

Storm Event: 1 yr

#### Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft <sup>3</sup> /s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
345.80	90.9	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
345.90	91.8	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)
346.00	92.6	(N/A)	0.00	Riser,Culvert (no Q: WQOrifice)



Subsection: Level Pool Pond Routing Summary

Label: SCM M (IN)

Return Event: 1 years

Storm Event: 1 yr

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#### Infiltration

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Infiltration Method (Computed)	No Infiltration
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#### Initial Conditions

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Elevation (Water Surface, Initial)	340.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	29.0 ft <sup>3</sup> /s	Time to Peak (Flow, In)	722.00 min
Flow (Peak Outlet)	0.3 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	1,440.00 min

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Elevation (Water Surface, Peak)	341.79 ft
Volume (Peak)	1.131 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.416 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.285 ac-ft
Volume (Retained)	1.131 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM M (IN)

Return Event: 10 years

Storm Event: 10 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	340.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	70.6 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	1.7 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	912.00 min

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Elevation (Water Surface, Peak)	344.06 ft
Volume (Peak)	2.833 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	3.882 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.075 ac-ft
Volume (Retained)	2.805 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM M (IN)

Return Event: 25 years

Storm Event: 25 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	340.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	86.6 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	8.1 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	781.00 min

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Elevation (Water Surface, Peak)	344.25 ft
Volume (Peak)	2.987 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	5.078 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.264 ac-ft
Volume (Retained)	2.812 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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Subsection: Level Pool Pond Routing Summary

Label: SCM M (IN)

Return Event: 100 years

Storm Event: 100 yr

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#### Infiltration

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Infiltration Method  
(Computed) No Infiltration

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#### Initial Conditions

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Elevation (Water Surface, Initial)	340.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.0 ft <sup>3</sup> /s
Flow (Initial Infiltration)	0.0 ft <sup>3</sup> /s
Flow (Initial, Total)	0.0 ft <sup>3</sup> /s
Time Increment	1.00 min

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#### Inflow/Outflow Hydrograph Summary

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Flow (Peak In)	110.2 ft <sup>3</sup> /s	Time to Peak (Flow, In)	721.00 min
Flow (Peak Outlet)	31.9 ft <sup>3</sup> /s	Time to Peak (Flow, Outlet)	751.00 min

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Elevation (Water Surface, Peak)	344.65 ft
Volume (Peak)	3.323 ac-ft

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#### Mass Balance (ac-ft)

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Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	7.131 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	4.314 ac-ft
Volume (Retained)	2.815 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.0 %

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